Agency: Commerce, Community and Economic Development
Grants to Named Recipients (AS 37.05.316)
Grant Recipient: Tok Community Umbrella Corporation

Project Title:

Tok Community Umbrella Corporation - Upper Tanana Valley Wood Chipper Project

State Funding Requested: $ 500,000 **House District:** 6 - C
Future Funding May Be Requested

Brief Project Description:

Request is to start phase one of the project by purchasing a wood chipper.

Funding Plan:

Total Cost of Project: $7,260,000

	Funding Secured		Other Pending Requests		Anticipated Future Need	
	Amount	*FY*	*Amount*	*FY*	*Amount*	*FY*
There is no other funding needed						

Detailed Project Description and Justification:

The goal of this project is to provide local communities with low cost heating and electrical energy derived from the carbon neutral by-products of area hazardous fuels reduction treatments. This coversion of waste to energy will benefit communities by:

1. Reducing the expenxe and complexity of fuels reduction treatments, leading to greater productivity, more rapid risk mitigation, and reduced chance of spruce bark beetle infestation.
2. Reducing dependence on expensice fossil fuels, which in the long run will reduce local heating fuel and electricity expenses, and will cut net carbon emissions.
3. Developing the basis for a local industry that will provide employment as well as a measure of self-sufficiency that will reduce dependency on the State for energy assistance.
4. Improving habitat for moose, small mammals, and other wildlife immediately adjacent to communities, contributing to accessible subsistence hunting and trapping opportunities.

With the purchase of a wood chipper, the project planners expect to be able to start clearing wood and storing the chipped product for use in heating the Tok School.

Project Timeline:

Project will begin in September of 2009 and continue until April 2012.

Entity Responsible for the Ongoing Operation and Maintenance of this Project:

Tok Umbrella Corporation

For use by Co-chair Staff Only:

4:19 PM 4/29/2008

Contact Name: Melanie Herbert
Contact Number: 465-4527

Grant Recipient Contact Information:

Contact Name: Kathy Morgan
Phone Number: (907) 883-4481
Address: PO Box 547 Tok, AK 99780
Email:

Has this project been through a public review process at the local level and is it a community priority? [X] Yes [ ] No

For use by Co-chair Staff Only:

Contact Name: Melanie Herbert
Contact Number: 465-4527

4:19 PM 4/29/2008

Tok Community Umbrella Corporation
Box 547
Tok, AK 99780-0547

January 10, 2008

Representative Woodie Salmon
State Capitol, Room 114
Juneau, AK 99801-1182

Dear Representative Salmon:

The Tok Community Umbrella Corporation on behalf of the community of Tok and Tanana Chiefs Conference on behalf of their members are submitting this Capital Improvement Project (CIP) request. The Upper Tanana Valley Renewable Resources Initiative is a collection of closely related and inter-dependent projects which will benefit all residents of the area, including the villages of Tanacross, Dot Lake, Mentasta, Tetlin, Northway and potentially even Chistochina. All of the Native villages in the region support this proposal and did a significant part of the work in putting it together.

Included with this letter are:

- Cover Sheet
- Community Profile
- Contact Information
- Summary of proposals
- Hazardous Fuel Reduction Project
- Wood Chipper Project
- Boilers project
- Firefighting Access project

This initiative will cost more than the typical CIP, but if all parts of the initiative are funded, all of our Upper Tanana communities will be at less risk from wildfire as we turn what is now dangerous wildfire fuel into a resource to heat our schools and public buildings, save the State money, create economic opportunities, and generate electricity while we improve the wildlife habitat and access to wildlife for hunting, trapping and subsistence.

We are also including backup materials and documentation, our community wildfire plan and letters of support. We will also be sending a large aerial map and petitions in support of the proposal, but those likely will be in a separate envelope-- we have not yet gotten the petitions rounded up for inclusion in the main packet.

Since this is such a large ticket request which actually benefits many communities plus the traveling public, we are also going to try to persuade Governor Palin to add this to her proposed budget. If that happens, we would withdraw our request for a legislative addition to the budget and just ask that you support the proposal during the budget process. However, since we have not yet gained an audience with her and can't be sure of getting the initiative added into the Governor's budget, we are applying to you now through the CIP process.

It was a real pleasure to meet you at Fast Eddy's; and I thank you, TCC, and the various villages' representatives for traveling such a distance and for being so gracious in inviting my group to attend and giving us the opportunity to speak. Thank you!

Sincerely,

Kathy I. Morgan

Kathy I. Morgan, President

Capital Improvement Project
Cover Sheet

Upper Tanana Valley Renewable Energy Initiative

The Tok Community Umbrella Corporation on behalf of the community of Tok and the Tanana Chiefs Conference on behalf of their members throughout the upper Tanana valley are requesting funding of the Upper Tanana Valley Renewable Energy Initiative. Total cost of the project would be between $7.26 million and $11.26 million, depending on the boiler option chosen.

This renewable energy initiative includes several closely related projects:

Hazardous fuel mitigation, removing trees to reduce the risk to communities from wildfires in the surrounding spruce forest ($3.76 million)

Wood chipper to take the whole trees (tops, limbs, trunk, & all) and chip it into usable fuel – the trees are too small diameter to be of value even as cordwood in their natural state ($.5 million)

Access trails for use during the hazardous fuel mitigation, for harvesting trees, and nature viewing or hunting experiences ($1.5 million)

Boilers to heat the school and public buildings and make use of the chips produced by the projects above ($1.5 - $5.5 million)

This renewable energy initiative would provide local communities with low-cost heating and electrical energy derived from the carbon neutral byproducts of area hazardous fuels reduction treatments. This conversion of waste to energy will benefit communities by:

- Reducing the expense and complexity of fuels reduction treatments, leading to greater productivity, more rapid risk mitigation, and reduced chance of spruce bark beetle infestation.
- Reducing dependence on expensive fossil fuels, which in the long run will reduce local heating fuel and electricity expenses, and will cut net carbon emissions
- Developing the basis for a local industry that will provide employment as well as a measure of self-sufficiency that will reduce dependency on the State for energy assistance.
- Improved habitat for moose, small mammals, and other wildlife immediately adjacent to communities, contributing to accessible subsistence hunting and trapping opportunities.

Attached are the community profile and justification and expanded description and summary of each phase of the project, along with backup materials describing for each portion of the project.

Contact Information for This Initiative

Kathy Morgan
Tok Community Umbrella Corporation
P.O. Box 547
Tok, Alaska 99780
907-883-4481

Upper Tanana Valley Wood Chipper Project

Executive summary

The State of Alaska, Department of Natural Resources, Division of Forestry, Tok Area plans to remove thousands of acres of hazardous fuel within the next decade. Much of this fuel is less than eight inches in diameter and is not marketable. The current plan is to windrow and burn it. This is an extraordinary waste of our resources at a time when the technology exists and the need is there for renewable energy.

Using wood chips obtained from hazard fuel reduction projects as a source of renewable energy has become the preferred method of many agencies in dealing with these two issues. The Upper Tanana Valley is even more ideally situated to this project due to its vast quantities of non merchantable forest. A large industrial size wood chipper and truck can turn our area's wildfire hazard fuels into a source of renewable energy for many years. The amount of hazard fuel in the Tok area alone has been indentified as 30,000 – 38,000 acres. Mentasta and Tanacross also have thousands of acres of hazard fuel that must be removed before a catastrophic wildfire occurs. With a goal of removing 1,000 – 3,000 acres of fuel each year would take decades to remove the hazard fuels in the area. Many other villages also have hazardous fuels to be removed and the most economic way of doing it would be to use these resources as a product.

Additional Funding and State Support

TCUC and TCC would purchase the wood chipper and truck within 120 days of receipt of the necessary funds. This community chipper would then be housed at the Department of Transportation equipment yard and operated by Division of Forestry firefighters and the Village of Tanacross. Maintenance and operation of the wood chipper and truck would be paid from the project code that it worked on. This is the first time this project has been requested for the Upper Tanana Valley and there are no additional funds for this project that Tok Community Umbrella Corporation is aware of.

Justification and Priority

We feel that this project should receive the highest priority from our legislatures due to the renewable energy needs our country and state face. It will save the State of Alaska and its citizens a considerable amount of money on fuel reduction; create employment, improve the environment, and reduce our dependency on oil.

Upper Tanana Valley Renewable Energy Initiative

Community Wood Chipper Proposal

The Tok Comunity Umbrella Corporation (TCUC) on behalf of Tok and Tanana Chiefs Conference (TCC) on behalf of their members are requesting $500,000.00 to purchase a community wood chipper. This equipment would be used to turn the area's wildfire hazard fuels into woodchips that can be used as fuel in wood fired boilers to generate both heat and electricity.

The State of Alaska, Department of Natural Resources, Division of Forestry, Tok Area has plans to remove thousands of acres of hazardous fuel within the next decade. Much of this fuel is less than eight inches in diameter and not marketable which would then be windrow and burned. They also allow local residents to bring brush from their FireWise landscaping and tree thinning projects to a gravel pit where firefighters then burn it. This enormous pile (100'x 50') of brush is burned, which is repeated several times a year. This is an extraordinary waste of our resources, and contributes the green house gases and global warming. The technology exists to convert this wasted product into woodchips that would be used as renewable energy (heating and electricity) for our schools and communities.

This wood chipper can also be used on road right of way construction in new subdivisions, recreational trail, and fire lines. Using a chipper would: decrease the cost of projects; eliminate the need to burn large slash piles and the chance of an escaped fire decreasing the State's liability; save the State money on fuel reduction projects, and produce a marketable product. This piece of equipment would be an economic benefit to the community by creating employment opportunities, heating and electricity.

Upper Tanana Valley renewable Energy Initiative

Community Profile

The Upper Tanana Valley is home to the villages of Dry Creek, Dot Lake, Mentasta, Northway, Tanacross, Tetlin, Tok, as well as many residents who live along the Tok Cutoff, Alaska and Taylor Highways. Many of the nearly 2,500 people who live in the Upper Tanana Valley lead a subsistence lifestyle and work seasonal jobs. The area's economy is heavily dependent on government jobs and assistance especially in the winter, with a high unemployment rate. The cost of living, heating oil, and electricity in the Upper Tanana Valley are very high compared to other areas of the state that are on the road system.

This road system is an important transportation hub for people who live in the Forty Mile Country and traveling in or out of the State. While there is little economy, there are still residents moving into the area, and as Alaska continues to grow, the highway corridor becomes more important to all Alaskans. Should something ever happen to interrupt this corridor, even for a short time, it would have an impact throughout the State. During calendar year 2007, 49,106 vehicles carrying 98,012 passengers entered Alaska at the Alcan Border POE and most people who entered there also departed through the area. Short term road closures happened in 1990, 1998, and 2004 which impacted the local area businesses. With the possibility of a pipeline, railroad and fiber optic trunk line to the lower 48, the Upper Tanana Valley could see a significant increase in infrastructure needs and development in the future.

Average winter snowfall is approximately 36" and mild dry summers make for a semi arid climate. Large wildfires are common in the Eastern Interior, especially during lightning season which begins in June and ends in mid July. Urban interface fires have been particularly costly to the State, most recently the Dot Lake fire in 2005 which destroyed one house while threatening many others.

Summary of Upper Tanana Valley Renewable Resources Initiative

The Upper Tanana Valley Renewable Energy Initiative is being put forward by community leaders in order to address several issues important to local residents. Its goal is to provide local communities with low cost heating and electrical energy derived from the carbon neutral by-products of area hazardous fuels reduction treatments. This conversion of waste to energy will benefit communities by:

- Reducing the expense and complexity of fuels reduction treatments, leading to greater productivity, more rapid risk mitigation, and reduced chance of spruce bark beetle infestation.
- Reducing dependence on expensive fossil fuels, which in the long run will reduce local heating fuel and electricity expenses, and will cut net carbon emissions.
- Developing the basis for a local industry that will provide employment as well as a measure of self-sufficiency that will reduce dependency on the State for energy assistance.
- Improving habitat for moose, small mammals, and other wildlife immediately adjacent to communities, contributing to accessible subsistence hunting and trapping opportunities.

In order to achieve this goal, the Initiative will be accomplished in phases. Phase I, already underway, will inventory and assess hazard fuels and determine their energy potential, as well as seek efficiencies in hazard fuels reduction techniques and compare alternative energy and fuel transport technologies. During Phase II, wood chip-fired boilers will be installed in the Tok School and Alaska DOT/DNR/Tok VFD complexes and will be fed with waste fuels from local hazard fuels reduction treatments and will seek to convert local power generation to a wood-fired system. Phase III will involve the conversion of all public buildings in the Upper Tanana from oil fired heat to wood chip fired boilers Throughout all phases, an emphasis will be placed on development of local private sector capabilities for fuels reduction implementation, wood fuel harvest, processing and supply, as well as harvest of other marketable timber.

Severe fire seasons and large tracts of continuous fuels adjacent to communities expose Upper Tanana homes and businesses to the threat of wildfire each summer. Fuels reduction treatments authorized under the 2001 National Fire Plan and the 2003 Healthy Forests Restoration Act play an important role in mitigating this threat. Projects in Tok, Northway, Tanacross, Tetlin, and Port Alcan have already been initiated. These projects are expensive and time consuming. Treatments to date have cost over $1,000 per acre to complete and represent only a small portion of what will be required to safeguard Upper Tanana communities.

Currently, slash from fuels reduction treatments is burned in place or hauled to disposal sites and burned later. Slash is largely composed of small diameter trees and limbs that currently have no marketable value. Firewood is made available to the public, however most material is burned without attempt to harness its available energy. The cost and time required to burn slash contributes significantly to the overall expense and complexity of fuels treatments. Slash left unburned remains available to burn in a Wildland fire and may provide a vector for spruce bark beetle infestation. Under this initiative, all slash from these necessary treatments will be chipped on site and burned in boilers that will provide heat and ultimately electricity for local communities.

Upper Tanana fuel oil and electricity costs are among the highest along Alaska's road system. The Tok School alone spends about $168,000 per year on heating oil, and this cost is rising each year. Wood-fired boiler technology is already in existence, and is successfully being used in many areas of the country. Substitution of chipped wood for oil to fuel boilers in public buildings can reduce the cost of heating by up to 80%.

This initiative is designed to foster economic benefits beyond lower operating costs and relief from dependence on imported oil. The Upper Tanana Valley lacks local industry other than tourism. This results in a high unemployment rate, especially during the winter months when tourism is essentially nonexistent. The forestry industry that is the basis of this initiative will provide year-round employment and will reduce dependence on State assistance in the long run. Once wood-fired heating infrastructure is in place, the opportunity exists for development of a local pellet fuel industry which could ultimately supply the majority of the Region's electrical power needs. Forest roads constructed to support fuels reduction treatments will provide access to additional marketable timber and will make it economically feasible for local mills to operate year-round. Fuelbreaks will regenerate into new growth willows and grasses and will provide improved browse and cover for moose and small mammals, thereby increasing subsistence opportunities in the immediate vicinity of communities where they are most needed.

Wood-fired boilers offer environmental as well as economic advantages. Burning oil and other fossil fuels contributes to the production of carbon dioxide and other greenhouse gasses. Increased concentrations of these gasses in the atmosphere threaten to trap heat close to the earth's surface and contribute to global climate change. Even small rises in average global temperature can have disastrous consequences over the next 50 to 100 years. Wood also emits carbon dioxide when it is burned or left to rot. Unlike fossil fuels however, trees absorb carbon dioxide from the atmosphere and incorporate the carbon into their wood structure as they grow. The carbon released when a tree is burned or left to rot on the forest floor is roughly equivalent to the carbon stored over the tree's lifetime. Thus, a properly managed forest absorbs as much carbon as the fuel it provides produces and can be said to be carbon neutral.

Numerous local, Tribal, State and Federal organizations have been involved in the development of this initiative:

- Tanana Chiefs Conference
- Tetlin Village Council
- Tok Volunteer Fire Department
- Tok Umbrella Corporation
- Alaska Department of Natural Resources
- Alaska Department of Transportation
- U.S. Fish and Wildlife Service, Tetlin National Wildlife Refuge

The citizens of the Upper Tanana Valley would like to continue efforts to make local communities fire-safe and become leaders in the development of local renewable energy resources. The supporters of this initiative are committed to development of the necessary infrastructure and feel that with State support the Upper Tanana Valley can become a model for rural communities throughout the State. The potential economic and social benefits afforded by the initiative should merit special consideration by the legislature.

Upper Tanana Valley Renewable Energy Initiative

Community Wood Chipper Proposal

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The State of Alaska, Department of Natural Resources, Division of Forestry, Tok Area has plans to remove thousands of acres of hazardous fuel within the next decade. Much of this fuel is less than eight inches in diameter and not marketable which would then be windrow and burned. They also allow local residents to bring brush from their FireWise landscaping and tree thinning projects to a gravel pit where firefighters then burn it. This enormous pile (100'x 50') of brush is burned, which is repeated several times a year. This is an extraordinary waste of our resources, and contributes the green house gases and global warming. The technology exists to convert this wasted product into woodchips that would be used as renewable energy (heating and electricity) for our schools and communities.

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Upper Tanana Valley Wood Chipper Project

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Upper Tanana Valley Renewable Energy Initiative

Hazardous Fuel Reduction Project

Tanana Chiefs Conference (TCC), on behalf of their members, and Tok Community Umbrella Corporation (TCUC), on behalf of Tok, is requesting $3,760,000.00 to be added to the budget for DNR, Forestry, Tok Area, for three years of hazard fuel removal.
This money would fund a Type II Initial Attack Crew for three years of fuel reduction work at four months per year. The crew would be funded by suppression funds during fire season. The remaining money would pay for fuel reduction by mechanical means for three years at approximately $1,000.00 an acre. The plan calls for reducing hazard fuels from the villages of:

- Tanacross
- Tok
- Mentasta
- Northway
- Tetlin
- Dot lake
- Dry Creek

The Upper Tanana Valley, with its many villages, has a dangerous hazard fuel loading that threatens entire communities and the infrastructure along the Alaska Highway with a potentially catastrophic wildfire. The area has lost three homes to three separate wildfires since 2001.

In keeping with the Healthy Forests Restoration Act, which President Bush signed into law in 2003, residents of these communities are requesting the State of Alaska participate with them in managing our State forests and State lands by reducing the amount of hazardous fuels that exist partly from previous forest practices.

It is widely recognized that it is a matter of when, not if, a wildfire destroys a number of homes in the area unless the hazardous fuels are removed. The Federal Government and firefighting agencies agree that this is the safest and most cost effective way to fight wildfires in the urban interface.

Hazardous Fuel Reduction Project

Executive Summary

The State of Alaska has spent approximately 50 million dollars in fire suppression in the Upper Tanana Valley during the last 20 years. This amount does not include Federal spending on fire suppression which equals or exceeds the states spending. The 120 acre Dot Lake fire of 2005 in which one home was lost cost the State over $486,000.00.

The 2001 Red Fox fire (150 acre) in Tok, destroyed one home, forcing the residents to flee on foot as their truck burned with the house, cost the state over $617,000.00. Adjusting for inflation and for skyrocketing wildland urban interface suppression costs, the amount spent on that 150 acre fire could be as high as one million dollars today. These numbers do not reflect the inevitable court costs or the amount of money spent rebuilding homes that are lost in these fires. When a large fire finally burns significant part of one of the villages in the Upper Tanana Valley the suppression cost alone could easily exceed 10-20 million dollars. Years of litigation and repatriation to the people who lost homes could equal that amount. *The only way to prevent this fire is to remove the hazardous fuels.*

We feel it is less expensive for the state to spend money in a proactive manner which is safer and provides for long term employment. The U.S. Fish and Wildlife and the Bureau of Land Management recognizes this and has spent several hundred thousand dollars reducing hazard fuels in areas where there is a risk of wild fire originating from their lands encroaching on village lands. There are still large areas around these villages that have a tremendous amount of hazard fuels. While the Division of Forestry is trying to get residents in this area to adopt FireWise tactics, much of this fuel is on State Land and *a very real threat is from a fire originating on State Lands.*

Benefit to Wildlife Habitat and Subsistence Lifestyle

Another important benefit to this project is the wildlife habitat improvement. Much of the area to be treated is choked with over mature spruce forest that is not conducive to wildlife. The preferred prescription for the areas to be treated is to create a stand conversion by removing all the spruce trees, allowing the aspen and willows to regenerate. This will benefit the wildlife and the people who live a subsistence lifestyle.

Required Funds for Completion of Project

We are requesting $3,760,000.00 for fuel reduction in the Upper Tanana Valley over a period of three years. This would provide for approximately 1,000 acres of fuel to be removed mechanically at $1,000 per acre and 50 acres to be removed by hand crew at $4,000 per acre each year. It is important to note that the cost of fuel removal varies and agencies are constantly striving to find the most economical method.
This includes planning and designing the projects. The areas to be treated are listed in order of priority; all funds that are awarded to this project will be used in the order listed below. As we

continue with the fuel reduction program, the cost per acre may decrease significantly causing an increase in production beyond the forecasted acreage.

Justification of project

Awarding these funds can be justified by the amount of fire suppression money that will surely be saved by preventing an urban interface fire from burning out of control. **The amount of money saved could easily be in the millions**. A fire in the urban interface in one of our villages would cost an estimated $6,000 to $8,000 an acre (the same 2850 acres of proposed fuel reduction this money will pay for could cost 10 – 15 million dollars in fire suppression costs alone. There are many large fuel reduction projects in other parts of Alaska, Canada, and the lower 48 as governments and fire fighting agencies agree that this is safer and more cost effective way to protect our homes, resources, and lives from wild fire.

We feel that the number one responsibility of the Government is for the safety and security of the people; and since this is a life and property safety issue it should receive the highest priority. The residents of the Upper Tanana Valley live in fear each summer of losing their homes to a wildfire that originates from State land which has been allowed to over mature due to fire suppression by State agencies.

Timeline

This project could begin in September of 2008 and continue until April 2011.

Matching funds

There are currently no matching funds. US Fish and Wildlife and the Bureau of Land Management have administered funds for fuel removal in this area previously and might do so in the future.

Additional State Support

The Department of Natural Resources, Division of Forestry, Tok Area Office would be the administrator of the funds and oversee and maintain the project. They have some permits in place from the Division of Lands to conduct hazard fuel removal on State land. They have conducted fuel removal projects in the past which were funded by Fish and Wildlife.

Detailed Outline of the Upper Tanana Valley Hazardous Fuel Reduction Plan

This plan will be enacted according to the Community Wildfire Prevention Plan (Tok) which was mandated by Congress for communities to develop in an effort to reduce the costs of urban interface wildfires and restore our forests. Tok Community Umbrella Corporation (TCUC) is a signature on the Tok CWPP. Tok Forestry has agreed to implement the plan as outlined below.

1. Plan and design the fuel breaks, including determining land ownership and methods to be used.
2. Obtain permits for public lands.
3. Acquire land use authorization for private lands.
4. Conduct public meetings and notices.
5. Draft the scope of work for each project.
6. Advertise and award bids.
7. Supervise and administer contracts.
8. Monitor and document results.
9. Compile and submit documentation.
10. Provide maintenance.

Below is a detailed listing of the hazard fuels to be removed in the Upper Tanana Valley beginning in September 2008. All work will be done with hand crews and or machinery in accordance with local agencies policies and procedures. State of Alaska, Department of Natural Resources, Division of Forestry, Tok Area Office will manage the funds and oversee the project and submit progress reports to TCUC and TCC.

- Remove hazard fuels from around the Tok School, DOT, DNR, and the Tok Volunteer Fire Department. – 145 acres
- Remove hazardous fuels from critical ingress / egress roads in Tanacross and Tok. – 80 acres
- Remove hazard fuels from around the village of Mentasta, creating a fuel break on all four sides, and from the edges of the road leading into Mentasta. - 340 acres
- Remove hazardous fuels from adjacent to the Alaska Highway from the Alaska Highway / Tok Cutoff Junction, West to the Tanacross Airstrip Road – 60 acres
- Create a fuel break and improve existing fuel breaks around the Village of Tanacross - 60 acres
- Remove hazard fuels from the village of Tetlin – 20 acres.
- Reduce hazard fuels from in and around the Village of Dot Lake – 65 acres
- Remove hazard fuels from in and around the village of Northway- 20 acres
- Strengthen the existing fuel break north of Red Fox, from 300' wide to 660' – 340 acres
- Improve power line clearings - 280 acres
- Remove hazardous fuels from the Dry Creek access road and around the village - 60 acres
- Remove hazardous fuels from three State Park Campgrounds – 60 acres
- Create a fuel break 660' wide from South Fireweed Road to Eagle Trail – 360 acres

- Create a fuel break from Mackenzie Road, North to the Tanana River 660' wide – 320 acres
- Construct a 3 mile extension, with a 660' wide fuel break from Borealis Road to Fireweed Road, – 240 acres
- Remove hazardous fuels from public property in other strategic locations in the Upper Tanana Valley such as State land bordering the U.S. Coast Guard Loran Station, airstrips, and communication towers – 500 acres

Upper Tanana Valley Renewable Energy Initiative

Wood Chip Fired Boilers

Tok Umbrella Corporation is requesting CIP funding for wood chip fired boilers for the Upper Tanana Valley. There are several options when considering which boiler system to choose.

Option one;
One boiler would be installed at the Tok School and another boiler will be shared by Tok DOT, Forestry, and the Volunteer Fire Department. These boilers would be the first of many to be installed at schools and public buildings in the Upper Tanana Valley. With the increasing price of heating oil, the savings will more than pay for the installation and cost of these boiler systems expected lifetime use. These boilers cost 1.5 million each. The price includes all engineering and installation with training and follow up consultation. It is important to note that these type systems are widely used in the Lower 48 and Europe with great success.

Option two;
A single boiler that provides steam heat would be capable of heating the same buildings as described above from one location due to the fact that steam can be pumped a great distance. This boiler would also be able to provide heat to many other buildings within the surrounding area. Cost is 3 million dollars and as above, this system is widely being used with great success.

Option three;
A wood chip fired boiler that produces electricity and produces steam heat as a byproduct makes the most economic sense. Electric rates in the Upper Tanana valley are incredibly high and combined with the price of heating oil; the cost savings of using this method would be enormous. Alaska Power and Telephone currently provides power to Tok, Tanancross, Tetlin, and Dot Lake. Current demand is approximately 1.4 megawatts.
A one megawatt generator that will also provide steam heat would cost 5 million dollars. A two megawatt boiler would cost approximately 5.5 million dollars. Once again, theses boilers are in use in many places and the contract for this boiler would include all of the engineering. The cost would be offset by the virtually free fuel to run it (woodchips from fuel reduction projects) and it would save the State an incredible amount of money over its lifespan while emitting no greenhouse gasses and providing for self sufficiency for the area.

Option four;
A 5 megawatt boiler could be located in Tok and supply the electrical needs of all the surrounding villages and communities as far a way as Chistochina. This would require an intertie to the rest of the state in order to supply electricity to those areas. The cost of this system is approximately 15 million dollars. This option provides many long term benefits.

Tanana Valley Renewable Energy Initiative

Executive Summary

The Upper Tanana River Valley's location on the Alaska Highway meets the transportation needs to succeed at this program. There are many thousands of acres of wildfire hazard fuels to maintain such a project. All state agencies and cooperators have agreed to implement this plan. It has cost the State of Alaska and the Federal Government hundreds of thousands of dollars to remove just a small amount of these fuels and burn them off in slash piles. *These are fuels that could be going towards heating our schools and supplying energy to our communities.* The extreme winter weather will provide for great documentation standards and insure rapid return on investment.

The technology, resources, and expertise exist for this project, and all necessary agencies and contractors are in agreement and ready to move forward. This is a project that can be a model for the rest of Alaska, and be shown as an example of good fiscal leadership in government. Tok Community Umbrella Corporation, Tanana Chiefs, and Tetlin Tribal Council are in agreement that the goal is to ultimately supply power to the entire Upper Tanana Valley and steam heat to all public buildings and where possible, private businesses and residents using wood chips as fuel. These wood chips would in large part, be supplied by wildfire hazard fuel reduction projects that will have to be funded anyway, making the material very inexpensive to the end user.

Alaska Power and Telephone is in agreement with this plan as they too are looking for a renewable energy source

Justification

Of all the possible State funded programs, this one would be very easy to justify given the benefits described above. It is time for the State of Alaska to show a commitment to lowering fuel and electrical costs for our residents, reduce our dependence on fossil fuels, and take a step towards protecting our environment, while saving money. While other areas of our country have taken steps to do the same, it is not too late to be on the cutting edge of renewable energy production and build something that our State can truly be proud of.

Priority

We believe this project should receive the highest priority due to the many benefits of renewable energy. It is a cost saving measure for the State of Alaska and its citizens and it will facilitate the removal of highly hazardous fuels that threaten homes and lives while providing for local employment and economic self sufficiency for our villages.

Additional Funding

We are unaware of any additional funding for this project; however we will continue to pursue all options.

Timeline

The timeline for this project is dependent on funding and once implemented, it would continue for many decades.

Additional State Support

The additional State supports needed for this project are in the form of cooperation from State Forestry in Tok and the Division of Lands in providing land and the permits to supply the fuel. Tok Forestry has assured us that this project is in their best interest and independent surveys conducted by UAF conclude that there is a virtually "inexhaustible supply" of woody biomass in the area.
A feasibility study will not be needed for this project as other schools in the country have installed wood chip fired boilers with great success and one is operating in the village of Dry Creek.

Savings

The price of heating oil in Tok is \$3.49 per gallon on 12/13/07. We anticipate that the State of Alaska will be able to reduce their fuel bills for these buildings by 80%, thereby paying for the boilers in a few years. The State buildings that receive these boilers will be heated by a local product, providing much needed employment opportunities while allowing the Upper Tanana Valley to become more self sufficient. The savings generated by converting all or most of the central part of villages to wood chip fired heat and all of the area to chip fired electricity would be hundreds of thousands of gallons of oil, resulting in several million dollars per year.

Upper Tanana Valley Renewable Energy Initiative

Firefighting Access and Resource Trails Proposal

Executive Summary

The Upper Tanana Valley has a vast forest that is owned by the State of Alaska and is difficult to access due to lack of roads or trails. This lack of access is affecting the residents' ability to harvest timber and firewood. It is also affecting small commercial timber companies' ability to operate. The region's underdeveloped tourist industry would also be improved by the construction of trails that access our resources. The area's rich history and rugged landscape could be a big draw but there is no access that leads to the most interesting areas. To be able to entice tourists to stay for even a day or two would bring a significant amount of revenue to the area and the State. Employment opportunities in the form of guided tours would be a possibility if there were quality gravel roads that led to areas of interest. Tok Community Umbrella Corporation (TCUC) on behalf of Tok and Tanana Chiefs Conference (TCC), on behalf of their members is requesting funds in the amount of $1,500,000.00 to build trails to these resources. This money would be directed to Tok Forestry's budget to be administered by them with progress reports submitted to TCUC and TCC annually. These trails would require little or no winter maintenance by the State.

Justification

This project is in compliance with the renewable energy initiative proposed by Governor Palin. With these trails the area's resources can be more properly managed while providing access to vast reserves of renewable energy. They would also provide access to firefighting equipment and crews in the event of a wildfire. It is the State's responsibility to provide infrastructure as well as provide for public safety.

Level of Need

Access to resources in the Upper Tanana Valley has been a problem for many years. With the rising price of fuel the problem has been exacerbated significantly. Wildfires have created large areas of firewood but it cannot be accessed. We feel that the level of need is very high and the State would benefit greatly from the improved infrastructure in this area.

Funding

We have not requested funding from any other sources and have not requested funds for this project in the past. No additional support for this project will be required.

Outline

This plan calls for 25 miles of trails to be constructed in the Tanacross, Tok and Tetlin areas of the Upper Tanana Valley. The estimated cost is $60,000 per mile of trail. The following list of projects has been prioritized by TCUC and TCC with the assistance of local State agencies and village leaders.

- Improve the existing Old Alaska Highway where it crosses Porcupine Creek and extending the Road 11 miles to the north.
- Build 1.5 miles of access trails in the Village of Tanacross
- Build 8 miles of access from the Tetlin Road to the Tok River
- Extend Mackenzie Trail Road 4 miles north to the Tanana river
- Construct Eagle Peak Fire Lookout trail – 3 miles
- Construct a 4.5 mile extension of Fireweed Road south to Eagle Trail
- Construct a 3 mile extension of Borealis Road west to Fireweed Road

Letters of Support

STATE OF ALASKA

DEPARTMENT OF NATURAL RESOURCES

DIVISION OF FORESTRY
TOK AREA

SARAH PALIN, *GOVERNOR*

PO Box 10
Tok, Alaska 99780
PHONE: (907) 883-5134
FAX: (907) 883-5135

January 10, 2008

To whom it may concern,

Tok Forestry would like to offer support for the Upper Tanana Renewable Energy Initiative put forth by Tok Community Umbrella Corporation and Tanana Chiefs Conference. This initiative addresses many concerns expressed by residents of the Upper Tanana Valley while addressing the wildfire hazard fuel reduction issue that is a concern to Forestry and other firefighting agencies.

With the skyrocketing cost of suppressing wildfires, all agencies involved in theses activities recognized the need for an initial attack capability that would prevent small fires from growing into large expensive project fires. The funds spent on initial attack resources have proved to be a valuable way to save local, state and federal government money while protecting structures, resources and even lives. However, the successful suppression of fires within our towns and villages has helped to create a forest that contains volatile hazardous fuels. The removal of these fuels is widely seen as the surest and most economical way to protect our resources.

With our firefighting resources budget stretched thin it is imperative that we act in a proactive as opposed to reactive manner. Add to this the ever increasing cost of home heating oil and electricity; we cannot afford to delay the implementation of a renewable energy plan. The fact that this plan in particular addresses the issues of employment, the ecology, economic advancement and self sufficiency for our villages while potentially saving the State of Alaska millions of dollars makes it worth special consideration by our legislatures.

Sincerely,

James Folan
Prevention Technician
Tok Area Forestry

40-MILE AIR

P.O. BOX 539
MILE 1313 ALASKA HIGHWAY
TOK, ALASKA 99780
907-883-5191
FAX - 907-883-5194

Fairbanks Int'l Airport
6450 Airport Way Suite 20
Fairbanks, Alaska 99709
907-474-0018
FAX - 907-474-8954

January 3, 2008

To Whom It May Concern:

I have read the Upper Tanana Renewable Energy Initiative proposals put forth by the Tok Community Umbrella Corporation and would like to offer this letter of support.

Making good use of the thousands of cords of wood that needs to be removed for fuel reduction is a great idea. I believe, given today's fuel prices, this makes good economic sense. Because of that, it would be easy to involve private enterprise as much as and as soon as possible.

I am glad to see that involvement is one of the goals of the plan.

Thank you for your time and consideration.

Sincerely,

Leif Wilson
President

Letter of Support

I have read the Upper Tanana Renewable Energy Initiative proposals put forth by the Tok Umbrella Corporation and I support the plan.

Bill Arpino
Burnt Paw & Cabins Outback
Northland Specialties inc
Box 7
Tok, AK 99780

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(907) 883-5752

P.O. Box 428

Tok, AK. 99780

WORK FOR Young's Timber

I Think IT IS A Excelent Idea.

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Mark Sakalaskas 883-5430

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Tetlin National Wildlife Refuge
P.O. Box 779
Tok, Alaska 99780-0779

IN REPLY REFER TO:

January 8, 2008

Dear Sirs:

Since 2003, the Tetlin National Wildlife Refuge has sponsored hazardous fuels reduction projects in and around the communities of Northway, Port Alcan, Tetlin, and Tok under the authority of the 2001 National Fire Plan. A variety of manual and mechanical treatment methods have been employed, all of which require disposal of slash material to decrease fuel loading and lessen the threat of bark-beetle infestation. Although slash is generally made available to the public, the small diameter of slash material often reduces its suitability for use as home firewood. The only currently viable alternative, on-site burning, has proved to be problematic as well as expensive and does not address National Fire Plan direction to seek utilization of biomass resulting from fuels treatments.

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Sincerely,

Tony Booth
Tetlin NWR, Refuge Manager

Letter of Support

I have read the Upper Tanana Renewable Energy Initiative proposals put forth by the Tok Umbrella Corporation and I support the plan.

Keith Hostetler PO Box 827 Tok AK 99780 5052-0103

Letter of Support

I have read the Upper Tanana Renewable Energy Initiative proposals put forth by the Tok Umbrella Corporation and I support the plan.

[illegible]

907-590-0455

Letter of Support

I have read the Upper Tanana Renewable Energy Initiative proposals put forth by the Tok Umbrella Corporation and I support the plan.

Bryce C Conrad

BRYCE C. CONRAD

Box 738
Tok, AK 99780

907-883-4301

Letter of Support

I have read the Upper Tanana Renewable Energy Initiative proposals put forth by the Tok Umbrella Corporation and I support the plan.

Alaska Gold Shop. Janice Hauser. 907-883-50.

Letter of Support

I have read the Upper Tanana Renewable Energy Initiative proposals put forth by the Tok Umbrella Corporation and I support the plan.

Bill & Priscilla Drake PO Box 521 Tok, AK 99780

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Sincerely,

Tony Booth
Tetlin NWR, Refuge Manager

Donald and Mary Lou York
P.O. Box 574
Tok, AK 99780
907-883-4379

Jaunary 9, 2008

After reading the Upper Tanana Renewable Energy Initiative Proposal from the Tok Community Umbrella Corporation. We would like to offer our letter of support.

The lifestyle and already existing hardships of living in the Alaska Interiors' small villages and towns, along with the ever increasing fuel and energy costs.

We feel the proposal make very good sense to us.

Thank you,

Donald C. York
Mary Lou York

Donald and Mary Lou York

GOLDEN BEAR
MOTEL
Ph. (907) 883-2561 Fax (907) 883-5950
P.O. Box 500 • Tok, Alaska 99780

To whom it may concern; 1/9/08

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The economy of the interior communities is most often very fragile and has little profit margin to encourage investors to risk capitol for expansion or development. Therefore there has been comparatively little expansion of the interior communities. Often these cannot even provide jobs for their children who are then forced to move into the more developed areas to be able to afford a home and family. The interior or bush communities are finding it difficult to maintain a viable population. Now with the huge increase in the cost of utilities it has become impossible for some businesses to remain open for through the winter and all will be adversely affected year round. This further contributes to local unemployment.

The Tok Community has the addition burden of a privately owned for profit monopoly as its supplier of electricity and telephone. Their motivation is not, as with the REA's, the production the most economically priced product for its members. Their motivation is in the maximization of profit for the stockholders. There is no chance that they will make any sincere effort to reduce costs to their customers as this will only negatively impact their profit and reduce the dividend to the stockholder.

It is therefore imperative to our economic survival that an alternative energy source be developed that will not require substantial dividends be paid to its owners and is more responsive to its community responsibilities.

Sincerely

James H. Jenkin manager
Golden Bear Motel LLC

Main Street Motel
P.O. Box 422
Tok Alaska 99780
907-883-6246

January 4, 2008

To whom it may concern:

I have read the renewable energy proposal put forth by the Tok Umbrella Corporation and feel it is a valid answer to an important issue. As a business that switched to wood heat and wood fired domestic water in 2005 we feel very strongly that the State of Alaska cannot continue to heat our public buildings with fuel oil when the technology and resources exist to use renewable resources. We also realize that the monetary savings to the State would be tremendous.

Sincerely,

James Folan
President

Letter of Support

I have read the Upper Tanana Renewable Energy Initiative proposals put forth by the Tok Umbrella Corporation and I support the plan.

Sue Hayner
Sue Hayner
General Manager January 7, 2008

Fast Eddie's Restaurant
and
Young's Motel

Letter of Support

I have read the Upper Tanana Renewable Energy Initiative proposals put forth by the Tok Umbrella Corporation and I support the plan.

I support the Upper Tanana Renewable Energy Initiative proposal, because the cost would decrease greatly ~~to~~ us the community and for the State also.

Candy Thoyse

AIP Construction Inc.

Box 276
Tok, Alaska 99780

January 4, 2008

To whom it may concern:

We have read the Draft Summary of the Upper Tanana Valley Renewable Resources Initiative and would like to offer our support of the proposed plan.

As a company that specializes in energy efficient construction we recognize the value of reducing our dependency on fossil fuels. We also feel that the State of Alaska is woefully behind on this issue. With the need for hazard fuel reduction and local employment opportunities, this is a plan that would benefit the State in many ways.

Thank you for your time and consideration.

Sincerely,

Judd + Dannie Rutledge

Judd and Dannie Rutledge
President and Treasurer

Letter of Support

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[illegible]ARD'S AUTO + TOWING TOK 907 883550 [illegible]

Richard F. Drummond

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I have lived in TOK for 40+ years. IT is A very good idea with what They have come up with, I am for it.

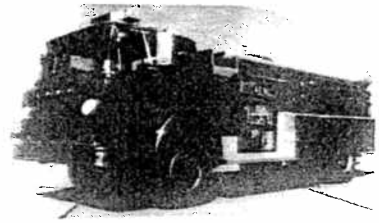
Nugget Const. Inc.

Jan 4, 08

John Terwilliger

TOK FIRE DEPARTMENT

Box 76
Tok, Alaska 99780



January 4, 2008

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The largest operating expense of the Tok Volunteer Fire Department is heating oil. On average the station buildings burn 4000 gallons per year. As a Volunteer Fire Department we can get grants for training and equipment but for operating expenses we are on our own. With the ever-increasing price of heating fuel, even with our efforts, i.e. new doors, new furnace and ceiling fans, we are still losing the battle. Frozen trucks won't do the community any good.

Being a small community, with the present high fire danger, this plan seems feasible and necessary; the other benefits are pure gravy.

Thank you for your time and consideration.

Sincerely,

Brian Thompson

Brian Thompson
Asst. Fire Chief

Tok Chamber of Commerce
Box 389
Tok, Alaska 99780
Phone: 907-883-5775
Email: john@rusyniak.com
Website: http://tokalaskainfo.com

SUPPORT OF RENEWABLE ENERGY INITIATIVE

Wednesday, January 9, 2008

TO WHOM IT MAY CONCERN:

Tok Chamber of Commerce would like to go on record in support of the Upper Tanana Valley Renewable Energy Initiative in it's efforts to free it's citizens from the economic burdens when foreign fuels are our only source of heat and electrical needs.

As a Chamber of Commerce we are not only interested in the cost savings to people of the region, but just as important, if not more are the employment opportunities to local residents rather than sending millions of dollars out of the community to foreign markets.

This issue of using biomass for heat and electrical needs has been the focus of multiple regional meetings over the past few years. Every meeting found nothing but positive reason from various interest groups to move forward in this direction.

On behalf of the Board of Directors of the Tok Chamber of Commerce, I thank you for your support of this renewable energy initiative to help free the Upper Tanana Region from it's dependency on foreign oil. Please contact me if there is any additional information that you require.

Sincerely,

John Rusyniak President

UNIVERSITY OF ALASKA FAIRBANKS
Interior-Aleutians Campus
Tok Center
College of Rural and Community Development
• P.O. Box 464 •Tok, Alaska • 99780-0464
PHONE • (907) 883-5613 • FAX • (907) 883-4327

February 4, 2008

The Honorable Woodie Salmon
State Senate
State Capitol, Room #114
Juneau, Alaska 99801

Dear Representative Salmon:

Please accept this letter of support for the Upper Tanana Renewable Energy Initiative that was submitted by the Tok Community Umbrella Corporation.

I am in support of removing trees in the area to lessen the threat of wildfire and then put them through a wood chipper to supply low cost heat and electricity to local agencies through large boilers. This project will provide much needed employment for locals. It will also improve the habitat for moose and other wildlife in the area of which will allow for subsistence hunting and trapping.

Making good use of the thousands of cords of wood that needs to be removed for fuel reduction is a great plan and with the price of fuel, this makes good economic sense. Currently, our schools and other non-profit organizations spend a big portion of their state/federal funding on heating oil.

It is time that we make changes to our heating and electrical resources as the prices continue to rise in rural Alaska.

Please take time to review and fund this proposal.

Thank you.

Sincerely,

Crystal Wilson
Tok Center Coordinator

Tom Dean
Box 742
Tok, Ak. 99780
Ph. 907-883-4737
Feb. 10, 2008

Representative Woodie Salmon
State Capitol, Room 114
Juneau, Ak. 99801

RE: Support of Tok Forestry's Bio Fuel Program:

Representative Salmon:

Please accept this letter as being in STRONG support of the BIO FUEL PROGRAM, being put forward by Tok Forestry, Tok Community Umbrella Corporation and Tanana Chiefs Conference, and the state financial support needed to make this project happen.

For years I have wondered why we are using oil to make electricity, heat large buildings, etc., when there are so many alternative energy sources in Alaska, especially bio fuel where available. We can sell the oil.

Please support this and other similar projects, they will be good for local economies and good for Alaska.

Sincerely,

Tom Dean

Tom Dean

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Tetlin National Wildlife Refuge
P.O. Box 779
Tok, Alaska 99780-0779

IN REPLY REFER TO:

January 8, 2008

Dear Sirs:

Since 2003, the Tetlin National Wildlife Refuge has sponsored hazardous fuels reduction projects in and around the communities of Northway, Port Alcan, Tetlin, and Tok under the authority of the 2001 National Fire Plan. A variety of manual and mechanical treatment methods have been employed, all of which require disposal of slash material to decrease fuel loading and lessen the threat of bark-beetle infestation. Although slash is generally made available to the public, the small diameter of slash material often reduces its suitability for use as home firewood. The only currently viable alternative, on-site burning, has proved to be problematic as well as expensive and does not address National Fire Plan direction to seek utilization of biomass resulting from fuels treatments.

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Tony Booth
Tetlin NWR, Refuge Manager

Letter of Support

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Larry Steinbarger

(907) 883-5752

P.O. Box 428

Tok, AK. 99780

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I Think IT IS A Excelent Idea.

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Burnt Paw & Cabins Outback
Northland Specialties inc
Box 7
Tok, AK 99780

TOK FIRE DEPARTMENT

Box 76
Tok, Alaska 99780

January 4, 2008

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Asst. Fire Chief

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Jan 4, 08

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Richard F. Drummond

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AIP Construction Inc.

Box 276
Tok, Alaska 99780

January 4, 2008

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Thank you for your time and consideration.

Sincerely,

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Judd and Dannie Rutledge
President and Treasurer

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Candy Thorpe

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Sue Hayner

Sue Hayner

General Manager January 7, 2008

Fast Eddie's Restaurant
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Sincerely,

Tony L. Booth

Tony Booth
Tetlin NWR, Refuge Manager

Donald and Mary Lou York
P.O. Box 574
Tok, AK 99780
907-883-4379

Jaunary 9, 2008

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The lifestyle and already existing hardships of living in the Alaska Interiors' small villages and towns, along with the ever increasing fuel and energy costs.

We feel the proposal make very good sense to us.

Thank you, Donald C. York
Mary Lou York

Donald and Mary Lou York

January 7, 2008

Jack & Kathy Turk
DBA Jack Turk Trucking
P. O. Box 756
Tok, Alaska 99780

This letter is in support of the Upper Tanana Valley Renewable Energy Initiative; it's goals to remove the substantial acreage of aging spruce forests surrounding our area, in an effort to protect this area from wildfires, and to develop an industry to provide heat and electricity from the by-products of this removal.

We see this effort to be very beneficial to all the residents of this area, in various ways. The logging industry in our area is spotty at best, and in the past has been undependable as a job and industry resource. The construction of boilers to produce heat and electricity for public buildings would bring stimulus and stability to the logging industry, and certainly would create employment opportunities year-around in this industry. Since this boiler system could use small diameter whole trees as well as the slash created by logging, it would be something every citizen could be involved in, when clearing private property or creating firebreaks around homes.

The already very high cost of fuels and electricity greatly stunt the economy in our area, taking a very big bite out of everyone's budget. These costs may possibly be greatly mitigated by the production of cheaper electricity and heating in our public buildings, possibly extending into the private sector.

Probably the most important factor of all is the very real high danger every summer of wildfires destroying everything in our area. There is hardly a home in or around Tok and outlying communities that is not in danger of being destroyed every summer during wildfire season. We are surrounded by mature aging spruce, which with every passing year become more volatile and dangerous. With the advent of possible global warming with it's changing and heightened weather patterns, we may experience more summer lightning strikes and longer fire seasons, with the eventuality of fires being too numerous and uncontrollable.

It is encouraging that the removal of the mature spruce will not only create firebreaks in wildfire fuels, but also cause at least partial stand conversions to aspen and willow, enhancing wildlife habitat for moose, hares and grouse. A widely diverse and stable environment is more able to withstand natural forces and events.

It is an important factor that this endeavor is self-sustaining, and not dependant on outside sources of fossil fuels. While the fuel source for this project is readily at hand, it is also of great importance that the fuel is carbon neutral. As participants and supporters of this initiative, we can be part of changing our world for the better, and be responsible stewards of our environment.

There seem to be many benefits to the goals of the Upper Tanana Valley Renewable Energy Initiative, from making our area and homes safer from wildfires, to decreasing our dependency on outside financial help for fuel and energy costs. The economic boost from invigorated existing industry and the development of new industry are very exciting concepts that will be created by this endeavor. We can be a model and example to other communities in the state as well.

Jack Tuck
Kathy Tuck

GOLDEN BEAR MOTEL

Ph. (907) 883-2561 Fax (907) 883-5950
P.O. Box 500 • Tok, Alaska 99780

To whom it may concern; 1/9/08

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The economy of the interior communities is most often very fragile and has little profit margin to encourage investors to risk capitol for expansion or development. Therefore there has been comparatively little expansion of the interior communities. Often these cannot even provide jobs for their children who are then forced to move into the more developed areas to be able to afford a home and family. The interior or bush communities are finding it difficult to maintain a viable population. Now with the huge increase in the cost of utilities it has become impossible for some businesses to remain open for through the winter and all will be adversely affected year round. This further contributes to local unemployment.

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Sincerely

James H. Jenkin manager
Golden Bear Motel LLC

Main Street Motel

P.O. Box 422
Tok Alaska 99780
907-883-6246

January 4, 2008

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Bill & Priscilla Drake   Po Box 521   Tok, AK 99780

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Alaska Gold Shop. Janice Houser. 907-883-505

Letter of Support

I have read the Upper Tanana Renewable Energy Initiative proposals put forth by the Tok Umbrella Corporation and I support the plan.

Bryce C Conrad

BRYCE C. CONRAD

BOX 738
TOK, AK 99780

907-883-4301

Letter of Support

I have read the Upper Tanana Renewable Energy Initiative proposals put forth by the Tok Umbrella Corporation and I support the plan.

[illegible]

907-54[illegible]-0[illegible]55

Letter of Support

I have read the Upper Tanana Renewable Energy Initiative proposals put forth by the Tok Umbrella Corporation and I support the plan.

Keith Hostetler PO Box 827 Tok AK 99780 505-0103

UNIVERSITY OF ALASKA FAIRBANKS

Interior-Aleutians Campus: Tok Center
College of Rural Alaska
P.O. Box 464 • Tok, Alaska 99780
(907) 883-5613 • FAX (907) 883-4327

February 4, 2008

The Honorable Woodie Salmon
State Senate
State Capitol, Room #114
Juneau, Alaska 99801

Dear Representative Salmon:

Please accept this letter of support for the Upper Tanana Renewable Energy Initiative that was submitted by the Tok Community Umbrella Corporation.

I am in support of removing trees in the area to lessen the threat of wildfire and then put them through a wood chipper to supply low cost heat and electricity to local agencies through large boilers. This project will provide much needed employment for locals. It will also improve the habitat for moose and other wildlife in the area of which will allow for subsistence hunting and trapping.

Making good use of the thousands of cords of wood that needs to be removed for fuel reduction is a great plan and with the price of fuel, this makes good economic sense. Currently, our schools and other non-profit organizations spend a big portion of their state/federal funding on heating oil.

It is time that we make changes to our heating and electrical resources as the prices continue to rise in rural Alaska.

Please take time to review and fund this proposal.

Thank you.

Sincerely,

Crystal Wilson
Tok Center Coordinator

August 7, 2007

Jeff Hermanns
Department of Natural Resources
Division of Forestry
P.O. Box 10
Tok, Alaska 99780

Hello Jeff Hermanns,

This letter is to let you know that we strongly support your efforts in regard to the firebreak work you have done for our community of Tok, Alaska. It is clear that we are "on the front lines" of fire danger each and every fire season and in the past we have been very vulnerable. Your action in creating the firebreak in the Red Fox area is very encouraging, and we hope that this work can continue until there is substantial firebreak protecting everyone in Tok.

On August 6, 2007 it was made very apparent that our power line right-of-ways are not protected because of their close proximity to dense spruce. We experienced moderate winds that day up to 30 mph, and power was cut off in many areas in and around Tok from trees falling into lines. Had this happened at a time of high fire danger it may well have been disastrous. If funding were made available to widen these right-of-ways it would go a long way toward protecting Tok.

It is apparent also from looking at aerial pictures of the Red Fox fire that our road right-of-way clearings are no deterrent to fire either. Hopefully these too can be funded to be widened substantially.

I am encouraged that the Forestry's Stewardship Land Enhancement Program is alive and well in Tok, and that we are given cooperation and assistance to protect and manage our private property. I feel it is very important that every landowner in Tok, whether residing in Tok or not, should be made aware of the fire hazard that their property presently is. All possible resolutions should be addressed to prevent fire from either spreading to properties because of continuous spruce stands nearby, or from fire that starts on properties and spreads outwards from it to other properties.

You also have good economic and innovative suggestions and ideas concerning the use of the fuels removed by the creation of firebreaks, and the removal of excess fuels on private and state properties. It is very encouraging that there are ways to use these resources, and that the use and management of them will also benefit us all; not only in a monetary way, but also by reducing our vulnerability to wildfires.

Therefore, let it be known to all agencies concerned; Alaska Power & Telephone, State of Alaska Department of Transportation, Department of Fish & Game, US Fish & Wildlife Service Tetlin National Wildlife Refuge, Tok Volunteer Fire Department, Tok Chamber of Commerce and Tok Umbrella Corporation, the we support you 100% for the interest, energy and action you are bringing to the Tok Wildfire Protection Plan.

I am submitting this letter to those agencies.

Respectfully,

Jack & Kathy Turk

Jack & Kathy Turk

January 7, 2008

Jack & Kathy Turk
DBA Jack Turk Trucking
P. O. Box 756
Tok, Alaska 99780

This letter is in ~~support~~ of the Upper Tanana Valley Renewable Energy Initiative; it's goals to remove the substantial acreage of aging spruce forests surrounding our area, in an effort to protect this area from wildfires, and to develop an industry to provide heat and energy from the by-products of this removal.

We see this effort to be very beneficial to all the residents of this area, in various ways. The logging industry in our area is spotty at best, and in the past has been undependable as a job and industry resource. The construction of boilers to produce heat and electricity for public buildings would bring stimulus and stability to the logging industry, and would create employment opportunities year-around in this industry. Since this boiler system could use small diameter whole trees as well as the slash created by logging, it would be something every citizen could be involved in, when clearing private property or creating firebreaks around homes.

The already very high cost of fuels and electricity greatly stunt the economy in our area, taking a very big bite out of everyone's budget. These costs may possibly be greatly mitigated by the production of cheaper electricity and heat in our public buildings, possibly extending into the private sector.

Probably the most important factor of all is the very real high danger every summer of wildfires destroying everything in our area. There is hardly a home in or around Tok and outlying communities that is not in danger of being destroyed every summer during wildfire season. We are surrounded by dense, mature aging spruce, which with every passing year become more volatile and dangerous. With the advent of possible global warming with it's changing and heightened weather patterns, we may experience more summer lightning strikes and longer fire seasons, with the eventuality of fires becoming too numerous and uncontrollable.

It is encouraging that the removal of the mature spruce will not only create firebreaks in wildfire fuels, but also cause at least partial stand conversions to aspen and willow, enhancing wildlife habitat for moose, hares and grouse. A widely diverse and stable environment is more able to withstand natural forces (like wildfires) and events.

It is an important factor that this endeavor is self-sustaining, and not dependant on outside sources of fossil fuels. While the fuel source for this project is readily at hand, it is also of great importance that the fuel is carbon neutral. As participants and supporters of this initiative, we can be part of changing our world for the better, and be responsible stewards of our environment.

There seem to be many benefits to the goals of the Upper Tanana Valley Renewable Energy Initiative, from making our area and homes safer from wildfires, to decreasing our dependency on outside financial help for fuel and energy costs. The economic boost from invigorated existing industry and the development of new industry are very exciting concepts that will be created by this endeavor. We can be a model and example to other communities in the state as well.

Jack + Kathy Turk

TETLIN VILLAGE COUNCIL'S RENEWABLE ENERGY RELIEF PROJECT

Wood Chip Boiler heating System $495,000.00

Scope of Project

Tetlin Villages Council's Renewable Energy Relief Project is part of the Upper Tanana Renewable Energy Relief Initiative.

Tetlin Village Council buildings include its Community Hall, Clinic, Washateria, Head Start Community Center, and Haul Garage. All these buildings and the Tetlin School are centrally located. A wood chip boiler heating system would heat all these buildings. No matching grants are needed as all funds are being requested from the State.

Fuel (the wood chips) would be provided by Tetlin Village Council's request for hazardous fuel reduction grant funds, which is part of the Upper Tanana Renewable Energy Relief Initiative. The hazardous fuels would be stock piled instead of being burnt. The harvested hazardous fuels would be chipped for use by the wood chip boiler. The chipper that would be used is being requested by the Tok Umbrella Corporation as part of the Upper Tanana Renewable Relief Initiative for all entities involved for chipping hazardous fuel for all chip boilers being requested.

In 2007 Tetlin Village Council purchased 23,500 gals of fuel at a coat of $3.50 per gal at today's price equals $82,250. The wood chip boiler would save the Council $49,350 per year over heating fuel. That's a 60% savings.

Tetlin Village Council's budget and cash flow is being strained by the exploding price of energy. Energy costs are now taking funds away from the social well being of the Village. Tetlin Village Council's goal of Reversed Economics is to reverse the cash flow from the Village back into the Village. This is accomplished by reducing hazardous fuel and using those hazardous fuels for energy relief and creating sustainable jobs in the Village.

January 11, 2008

Community Profile:

Tetlin is a remote village located in the southeast interior region of Alaska, approximately 230 miles south of Fairbanks, and 65 miles from the Alaska/Canada border and accessible by twenty-three mile private, non-paved, off-road system year round. Tetlin is also accessible by small aircraft year-round and by riverboats when ice is not present in the water systems. Tetlin sits along side of the Tetlin River that which connects the Village to the Tanana River and Tetlin Big Lake. The Community has been in its current location for over twenty years, before relocating to the current site Tetlin residents lived at Last Tetlin Village. Last Tetlin is located twenty miles south of Tetlin on the Last Tetlin Creek, which runs into Tetlin Big Lake.

The native village of Tetlin is governed by an IRA Tribal Council pursuant to the IRA act of 1934 as amended in 1936 and is a federally recognized tribe. The people are Upper Tanana Athabascans with over 300 claiming membership in the tribe. All are recognized as tribal members. Tetlin Village Council is made up of seven members including four officers, a President, Vice President, and Secretary/Treasurer.

Public Facilities in the community includes a school, washateria, Tribal Community Hall, Haul Garage, Head Start Community Center, and a Health Clinic. Tetlin also has a dump, which needs to be relocated and brought up to a State of Alaska, Class III Landfill Standards.

As a result of the Alaska Native Claims Settlement Act (ANSCA in 1971, Tetlin Native Corporation was established. Tetlin chose not to enroll into a Regional Corporation such as Doyon and was entitled to more than 700,000 acres of land. In 1994, Tetlin Corporation transferred majority of the land to Tetlin Village Council. Most of the transferred land was selected around the village and included lands that are of great and vital to the cultural and traditional identity and subsistence activities of the Tetlin Tribal members. Approximately 640,000 acres of land is now owned by Tetlin Village Council.

Tetlin lands incorporate the upper Tanana River drainage ecosystem, which consists of a complex mixture of geomorphological and environmental features. In general, the southern boundary of the Upper Tanana Athabascans was defined by the Wrangell Mountains. This mountain range contains a number of glaciers that serve as the source for the White, Chisana, and Nabesna Rivers, along with their many tributaries. The Wrangell Mountains geographically separates the Tanana River valley from the southern coastal drainages. To the north of the Wrangell Mountains, the Nutzotin Mountain Range runs practically parallel, but the Nutzotin Mountains are not as high in elevation as the, nor as rugged in terrain. The White, Nabensa, and Chisana Rivers, which are fed from the Wrangell Mountains, cut through the mountain range; therefore the headwaters of these rivers can be characterized as intermontane basins that are on average 4,000 feet in elevation. This terrain almost abruptly gives way to a broad, flat, river valley, which is covered in numerous lakes, ponds, and steams and blanketed with spruce trees and forest. The average elevation of the river valley is about 2,000 feet. The water in this valley drains into the Tanana River which follows closely the northern boundary of rolling hills; these hills separate the river valley from the Yukon River drainage.

Justification and Level of Need:

The Tetlin Village Council is requesting funding to start and complete a Renewable Energy Relief Project, which is part of the Upper Tanana Renewable Energy Relief Initiative. Since public facilities in Tetlin are centrally located a wood chip boiler heating system would heat all of these buildings.

Tetlin Village Council's budget and cash flow is being strained by the exploding price of energy. Energy costs are now taking funds away from the social well being of the Village. By using hazardous fuels for energy relief Tetlin Village Council can reverse the cash flow from the Village back into the village, while creating sustainable jobs in the Village.

Fuel (the wood chips) would be provided by Tetlin Village Council's request for hazardous fuels reduction grant funds, which is part of the Upper Tanana Renewable Energy Relief Initiative. The hazardous fuels would be stock piled instead of being burnt. The harvested hazardous fuels would be chipped for use by the wood chip boiler. The chipper that would be used is being requested by the Tok Umbrella Corporation as part of the Upper Tanana Renewable Relief Initiative for all entities involved for chipping hazardous fuel for all chip boilers being requested.

Supporting Comments:

The local government of Tetlin, the Tetlin Village Council has passed a resolution supporting this project. A copy of the resolution is attached. Letters from other surrounding communities is also included.

Documentation of Local Matching Funds:

The Tetlin Village Council agrees to provide the following in kind match for the project. Tetlin will donate personnel time to make this project possible. The Council will provide the Administrators time and Council member's time. The total cost of this would be $10,000 for personnel costs, $3,000 for chainsaws and $5,500 for housing.

Documentation this project has not been requested before:

The Tetlin Village Council has not requested funding for the Renewable Energy Relief Project from the State of Alaska in the past

Time Frames for the Project:

This project will start as soon as we receive the funds from the State of Alaska. The timeframe for the project includes.

Aug. 2008	Funding Available
Aug. 15	Request for Bids
Sept. 15	Bid Accepted
Oct. 1	Construction Begins
Jan. 2009	Wood Chip Boiler On-Line

Contact Information:

Kristie Young, Tribal Administrator
Tetlin Village Council
PO Box 797
Tok, Alaska 99780
Phone/Fax (907) 883-2021

P.O. Box 797
Tok, Alaska 99780
(907) 324-2130 phone
(907) 324-2131 fax

RESOLUTION NO. 08-08-01 (e)

WHEREAS, the Tetlin Village Council is the duty constituted and legal governing body of the Native Village of Tetlin, Alaska and

WHEREAS, the Council has defined that reducing energy cost by reducing hazardous fuel and using those hazardous fuel for energy relief is extremely important and;

WHEREAS, the Tetlin Village Council agrees that this is an important step to reduce energy costs for the members of Tetlin.

WHEREAS, the Tetlin Village Council has agreed to donate personnel costs for the tribal administrator and council members.

THEREFORE BE IT RESOLVED: the Tetlin Village Council has agreed that the project for reducing energy cost by reducing hazardous fuel and using those hazardous fuel for energy relief, while creating sustainable jobs in the Village, is very important to the Village members and it is needed.

DULY ADOPTED this 11th day of January 2008.

This certifies that the above resolution was duly adopted at a convened meeting of the Tetlin Tribal Council, at which time a quorum was present. This resolution was adopted by a vote 5 for, 0 against, with 0 abstaining.

Michael Sam for
Donald Adams, President

Eva Thomas, Sec./Tres.

Tok
Community Wildfire Protection Plan

Figure 1 - Wildfire on Taylor Highway 2004

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Signature Page

As administrator of a land management agency or community organization represented in the Tok Wildfire Protection Plan, I concur with the following recommendations to implement this plan.

Department of Natural Resources (DNR)
Division of Forestry (DOF)

____
Jeff Hermanns - Area Forester

Department of Transportation

____
James Fehrenbacker – Tok Area Manager

Department of Fish and game

____
Jeff Gross – Wildlife Biologist

U.S. Fish and Wildlife
Tetlin National Wildlife Refuge

____
Peter Butteri – Fire Management Officer

Tok Volunteer Fire Department

____
Dave Bergstrom - Fire Chief

Tok Chamber of Commerce

____
John Rusyniak - President

Tok Umbrella Corporation

____
Kathy Morgan, President

1990 Tok River Fire

List of Interagency Planning Team Members

Jeff Hermanns	Tok Area Forester, State of Alaska, Division of Forestry
James Folan	Tok Fire Prevention Technician, State of Alaska, Division of Forestry
Peter Butteri	Fire Management Officer, US Fish and Wildlife Service, Tetlin NWR
Dave Bergstrom	Fire Chief, Tok Fire Department

Figure 2 - Bucket work out of Mosquito Fork

I. Executive Summary

The Tok Community Wildfire Protection Plan (Tok CWPP) is a collaborative effort that has been developed response to the 2003 Healthy Forest Reforestation Act (HFRA). This directs communities at risk of wildfire to develop a risk assessment and mitigation plan. The Tok CWPP is based on Preparing a Community Wildfire Protection Plan A Handbook for Wildland Urban Interface Communities (March 2004).

The Tok CWPP

- Assesses the risk posed by wildfire to the community of Tok.
- Identifies local values of concern.
- Identifies local fire protection response and capabilities as well as natural and man made barriers.
- Develops mitigation measures designed to protect identified values from the threat of wildfire.

Completion of the CWPP will provide direction for ongoing and future wildfire hazard mitigation efforts and will allow the community of Tok to take full advantage of HFRA benefits including prioritization for federal funding and self-determination of Wildland Urban Interface (WUI) boundaries.

While the burn scar of the nearly 100,000 acre 1990 Tok River Fire to the East of town provides a natural barrier to the threat of a large fire approaching from that direction, the town itself, and most of the surrounding subdivisions, are vulnerable to catastrophic wildfire due to an almost uninterrupted stand of white spruce that encompasses nearly the entire community. Frequent thunderstorms and associated lightning strikes in and around the community are a constant cause for concern during the peak lightning season in June and July. An even greater threat is posed by human caused fires in the local area. The continued expansion of the community will increase the risk for human-caused fires.

The State of Alaska, DNR, DOF, Tok Area is responsible for wildland fire protection in Tok and the surrounding area. . The U.S. Fish and Wildlife Service and Tok Volunteer Fire Department also support Wildland fire protection efforts.

The purpose of the CWPP is to reduce the threat of wildfire in the community of Tok by assessing the ignition risks, fuel hazards, and taking steps to mitigate them. The plan will also identify natural and man made barriers, fire protection response and capabilities, and values of concern.

Action items associated with this plan will be incorporated into two phases. The first phase will address the risk and propose steps to mitigate them. The second phase will focus on making the plan sustainable and strengthening it. The following actions are proposed to mitigate these threats:

Phase I

- Create a priority matrix that identifies hazard fuels, values at risk and areas to be treated. It is important that this matrix reflect hazards and mitigating measures within the community, and work outwards.
- Thin or remove fuel within the community at identified locations.
- Construct fuel breaks along easements. This is to provide access to sections that contain hazard fuels and create stand conversions. The removal of spruce trees and exposing the earth will promote the growth of Willows and Aspens. As much as ¼ to ½ sections may be cut during this part of the operation. The sections identified are North of Red Fox Drive, East of Eagle Subdivision, West and Southwest of Fales Road and Fireweed Lane south of Borealis.(see map of page
- Assess properties within the town for defensible space using Firewise guidelines and work with residents to improve the survivability of their homes;
- Develop local capabilities to provide contracted fuel reduction services;
- Strengthen local prevention programs and interagency cooperation;
- Develop and maintain an emergency evacuation plan.

Phase 2

- Provide sustainability through private enterprise participation in using wood for fuel and electricity.
- Develop and implement a house numbering system for emergency vehicles
- Procure additional funding for EMS and VFD
- Become a certified Firewise community and form an Emergency response task group that would meet once a month.
- Secure funding for the local radio station

II. Background

A. Community of Tok

Tok Alaska, with a summer population of about 1400 people, is located 200 miles southeast of Fairbanks in the Upper Tanana Valley, at the junction of the Alaska and Glenn (Tok Cutoff) Highways. Tok is an important transportation hub and the center of commerce for several villages in the area. The community is slowly expanding. People moving into the area for a variety of reasons and new subdivisions are being developed on the outskirts of town.

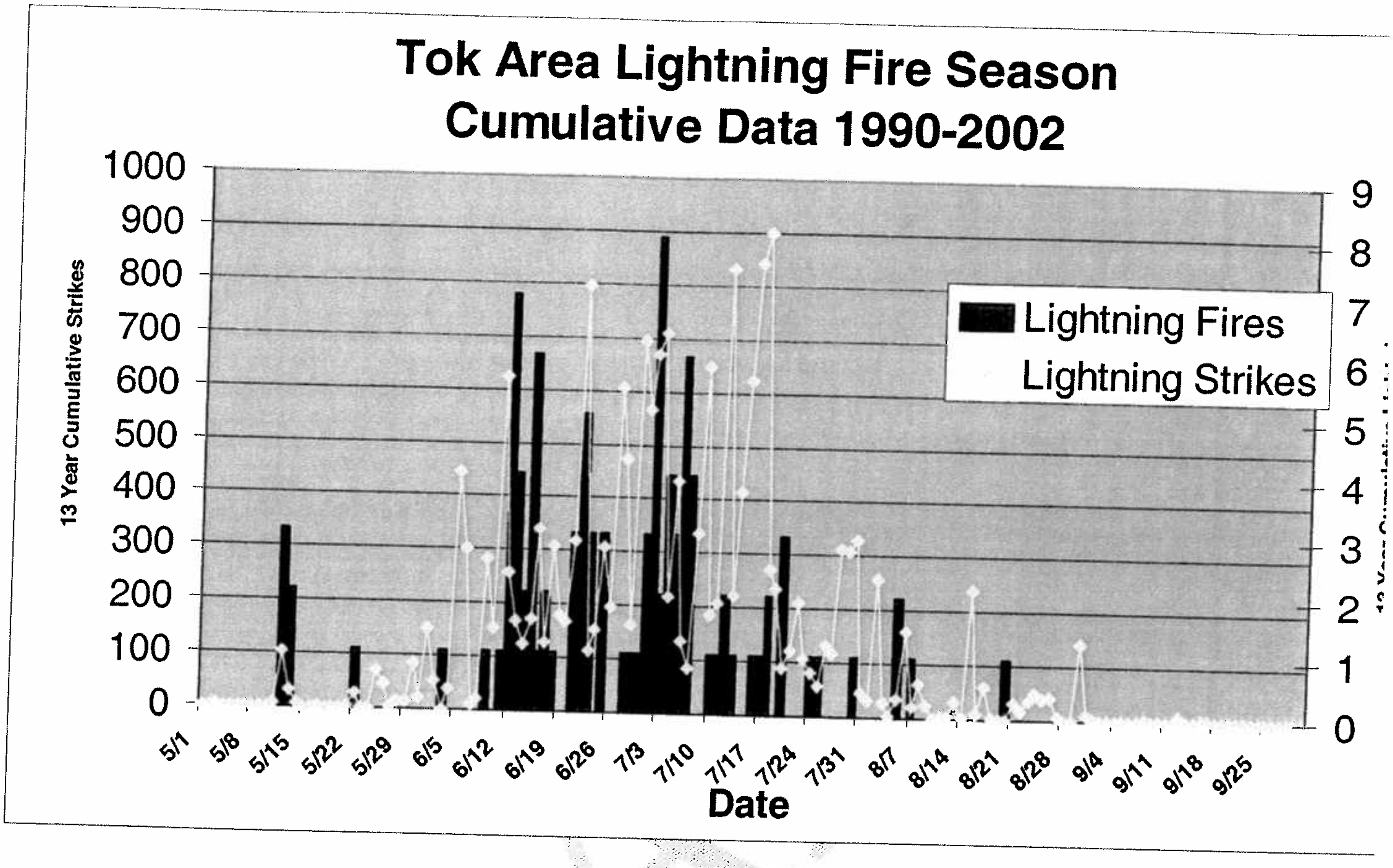
The community of Tok is part of the Unorganized Borough and has no local government. The Tok Community Umbrella Corporation was incorporated in 1986 and has served as a conduit for receiving State funding into the community.

Tok Area Fire Season

Fire season in the Upper Tanana Valley is highly variable. It begins some years as soon as the snow has melted in early to mid May. Typically, these early fires are human caused, though lightning caused fires may also occur. Because of the low moisture content in local snow, the severity of this early season is more dependent on spring breakup conditions than it is on the amount of over winter precipitation. Rapid thawing allows moisture to percolate downward leaving surface fuels dry, while a slow breakup impedes drying by holding moisture close to the surface above frozen layers. Early season fires tend not to burn deeply but may burn intensely and spread quickly across the surface.

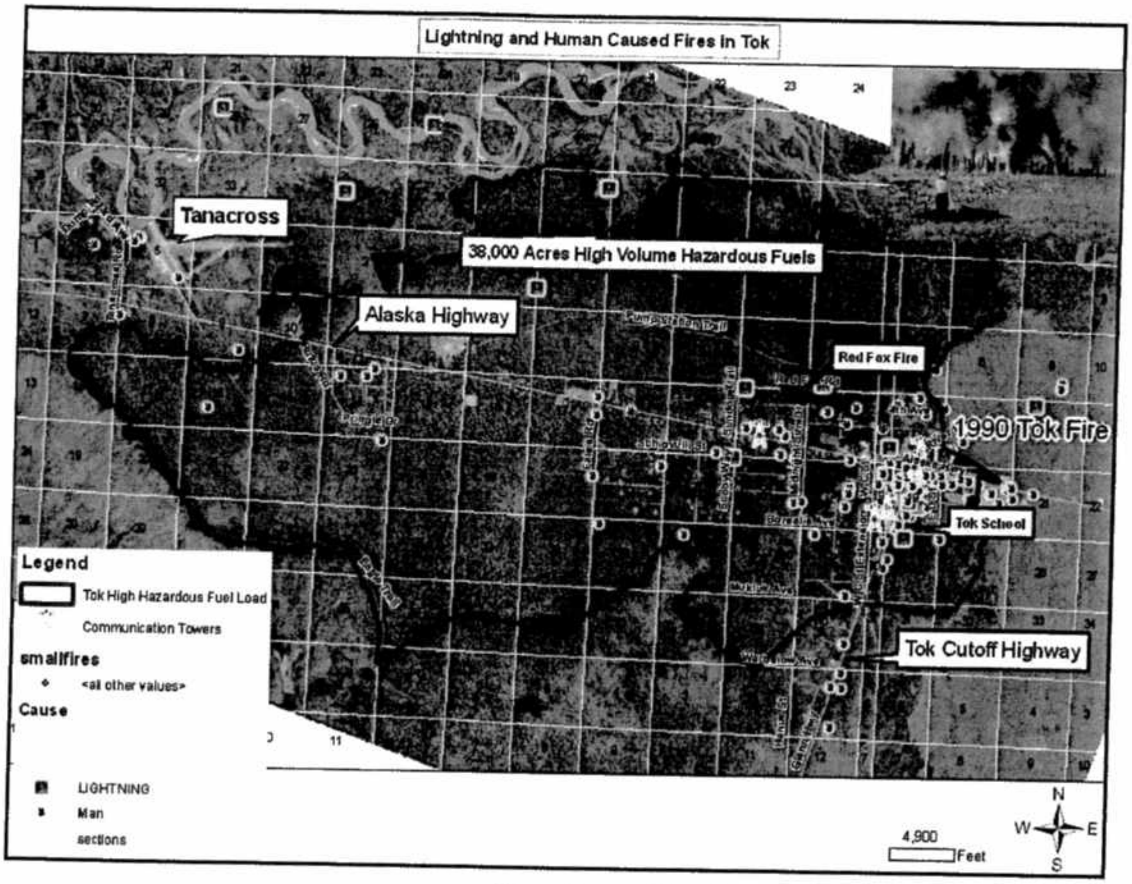
As green-up progresses and live fuel moistures rise during late May and early June, fires become less frequent for a time. As days lengthen further, increased differential heating becomes more conducive to convective activity, and the absence of significant rain causes surface fuels to dry. This effect peaks from mid June to mid July and is the basis for the "main" upper Tanana lightning fire season. This period coincides with increased human presence in the wildlands and the majority of human caused fires. The most active fire years are often characterized by large stable high-pressure systems over the interior which result in prolonged periods of hot, dry weather and more frequent low-precipitation thunderstorm. Other years are characterized by a series of low pressure systems that sweep across the valley and bring widespread rain.

By mid July, thunderstorm activity begins to lessen due to shorter days and less intense sunlight. Fuels can remain dry, allowing ongoing fires to continue burning, however new ignitions occur less often. Typically, large high-pressure systems give way to systemic moisture sometime in August. Without moisture, a late season can extend into September, usually relying on careless hunters for ignition sources. Although fires can burn into October if snowfall is delayed, rarely do they spread significantly.



Tok Area Fire History

Between 1984 and 2006, 1,113 wildfires, have burned 2,382,143 acres at a cost of over 50 million dollars to the State of Alaska (*This amount does not reflect federal spending).* Just sixteen fires accounted for over two million of these acres and in 2004 alone, record temperatures and drought conditions allowed six lighting-caused fires to burn 1.3 million Tok Area acres- more area than all fires in the previous 45 years combined. Although lightning is responsible for only 33% of Tok Area ignitions, lightning fires account for nearly 90% of the total number of acres burned. Human caused fires are most prevalent in the immediate vicinity of the community of Tok and other populated areas where values at risk often require aggressive suppression efforts. Notable human caused fires within the Tok Area Wildland Urban Interface (WUI) include the 150 acre Red Fox fire in 2001 and the 6,000 acre Tok River 2 fire of 2003. The 100,000 acre lightning caused Tok River Fire of 1990 also burned into the WUI, and is widely recognized as the first large scale urban interface suppression effort in the State of Alaska.


Lightning and Human Caused Fires in Tok
Tanacross
38,000 Acres High Volume Hazardous Fuels
Alaska Highway
Red Fox Fire
1990 Tok Fire
Tok School
Tok Cutoff Highway
Legend
Tok High Hazardous Fuel Load
Communication Towers
smallfires
<all other values>
Cause
LIGHTNING
Man
sections
4,900
Feet
N
W
E
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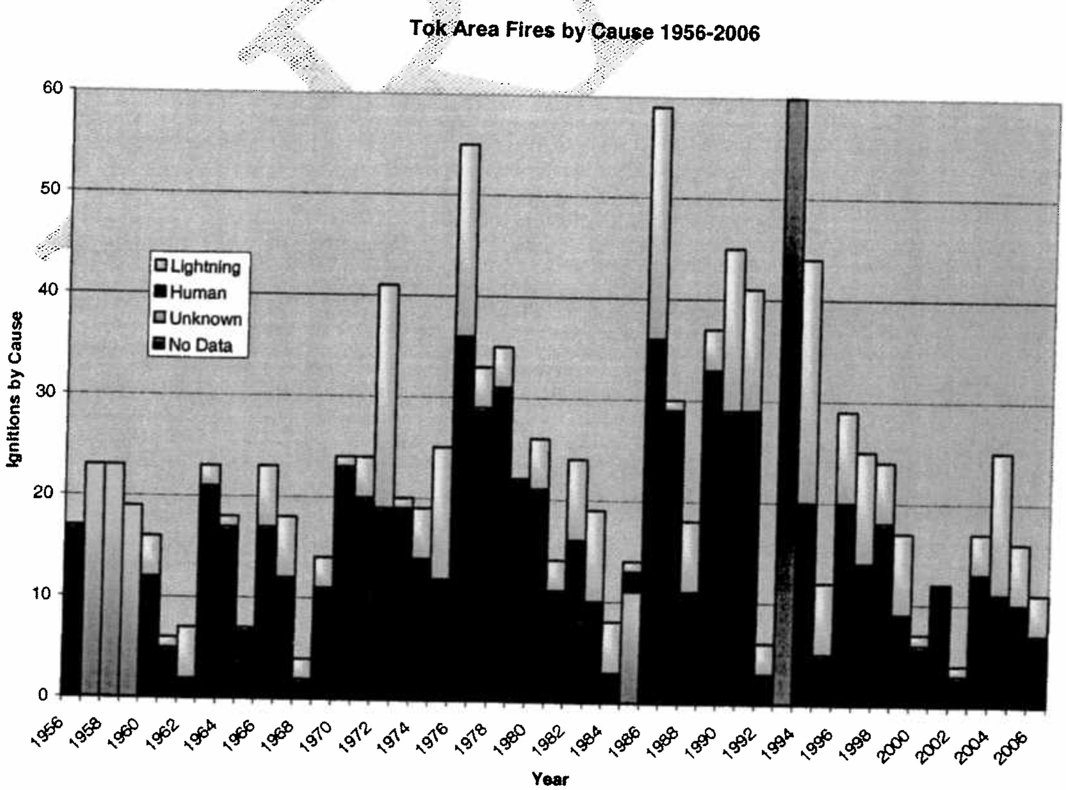
Tok Area Fires by Cause 1956-2006
Lightning
Human
Unknown
No Data
Ignitions by Cause
Year
0
10
20
30
40
50
60
1956
1958
1960
1962
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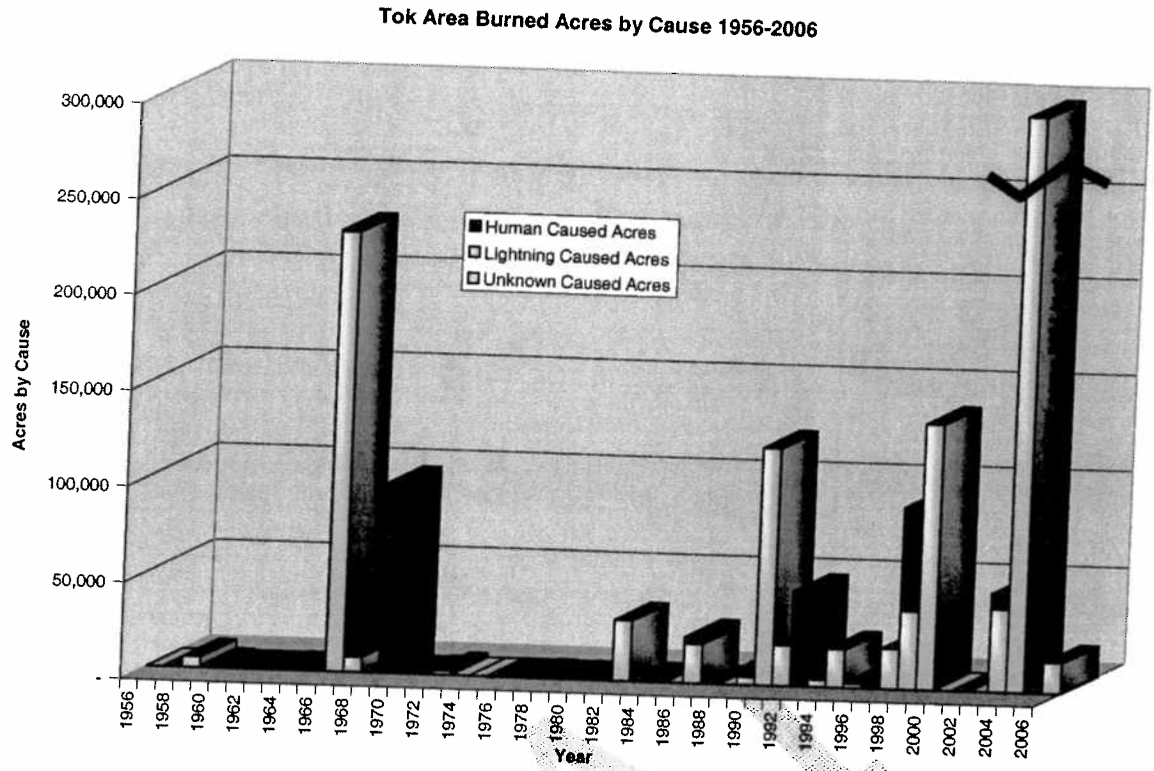


Tok Area Fuels

The community of Tok is constructed on well drained gravel soils of the Tanana River floodplain within a nearly contiguous 33,000 acre spruce/feathermoss stand. White spruce predominates, however black spruce is also present. A fire that gains a foothold in these continuous and volatile fuels under severe weather conditions can quickly outstrip the ability of firefighters to contain it as was evidenced in 1990 and again in 2004. Within the community, roads are often narrow and will serve only marginally as fuel breaks or routes for access or egress. Many homes are accessible only by narrow, one-way drives, and are surrounded by little or no defensible space. Poor access outside of the community road system limits possibilities for initial attack on fire starts north and south of town. The problems are compounded by a lack of nearby water sources.

Natural barriers to fire exist outside of the stand. It is bounded to the north by the Tanana River, to the east by the 1990 Tok River Fire scar, and to the south and west by the Alaska Range and an older (pre 1950) burn scar supporting Aspen and mixed Aspen/Spruce stands. These barriers, however, cannot protect Tok from fires occurring within their bounds.

An increased awareness of the WUI threat has many Tok homeowners taking steps to make their property more fire resistant; however a 2005 satellite image is a stark reminder of how much work is still to be done. The suppression of wildfires during the last fifty years has allowed the highly flammable spruce forest to age beyond its prime.

Tok Area Fire Management

The primary wildland fire suppression provider in the Tok Area since 1984 has been the State of Alaska, Division of Forestry. Eight Wildland Firefighter and Resource Technicians staff four engines and one helicopter in order to provide initial attack response for almost nine million acres. Other Wildland fire resources in Tok include an engine at the Tetlin National Wildlife Refuge and the Tok Fire Department, an all volunteer service equipped with six fire engines staffed by 9 firefighters that assists Forestry and responds to wildfires within its response area.

In addition to managing wildfires, area wildland fire personnel also responds to other emergencies through the Incident Command System (ICS), such as the earthquake of 2002 when multiple agencies, including FEMA, American Red Cross, and DEC used Tok Forestry as an Incident Command Post to provide relief to those affected by the earthquake.

Power-line in Tok area off of Birch Road
These easements would be a priority for improvement.

B. A Look at Two of Tok's Wildfires

Figure 3 - 1990 Tok Fire as seen from Forestry

1. The Tok River Fire - 1990

This fire was started by lightning July 1, 1990 and was fought for 56 long days. The fire burned nearly 100,000 acres or 150 square miles. Up to 1200 firefighters were working the fire at one time from the Western United States, Canada, and every corner of Alaska. 1,258,700 gallons of foam and retardant were dropped and 87 miles of fireline was built around the fire. There were 73 injuries and one helicopter crash and no fatalities. The direct cost of the fire was more than 25 million dollars with an estimated additional 6 million dollars in forest resources loss. It eventually destroyed one structure, threatened many more before firefighting efforts and a change in the weather helped to steer it away from town. This fire is a classic case of the need for fuel reduction on the outskirts of a town that has uninterrupted hazard surrounding it on all sides.

2. Red Fox Fire – 2001

The 150 acre Red Fox Fire of 2001 was a human caused fire on the northern edge of Tok that also destroyed at least one structure and cost approximately $650,000.00. While the 1990 Tok River Fire was pushed into Tok by general Easterly winds, the relatively small Red Fox incident was driven by a local wind caused by a downdraft from a cumulus cloud that pushed it towards a populated area. The time elapsed from the first fire engine on scene until structures became involved was a mere 22 minutes. Tok Forestry's helicopter was on a search and rescue mission in the Wrangell Mountains, and aerial resources from other stations were at least an hour away, complicating suppression efforts and underscoring the need for homeowners to adopt Firewise tactics in regards to making their homes more survivable in the face of a WUI Fire.

A home which survived the Red Fox Fire despite receiving enough radiant heat from the flames to discolor the paint on the siding and melt plastic rain gutters as well as candles sitting on the windowsills serves as an excellent example of the effectiveness of these techniques. This home had been built to Firewise specifications including metal siding and roofing, and vegetation had been cleared for 30' around the house.

Following the Red Fox Fire, Forestry ordered a National Fire Prevention and Education Team to help educate area residents about the Firewise steps necessary to make their homes more survivable. Many of this team's recommendations been incorporated into this CWPP including:

- Updating and maintaining the house locator program initiated by Tok Forestry after the 1990 Tok River Fire.
- Creation of a permanent prevention position at Tok Forestry- a recommendation that was accomplished in the spring of 2007.

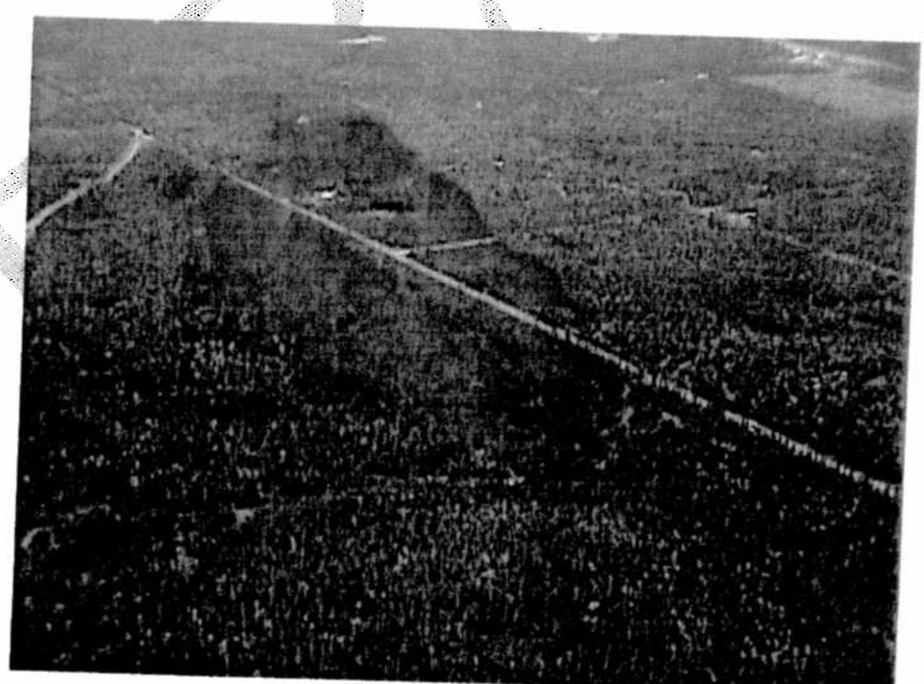


Figure 4 - Red Fox Burn Scar

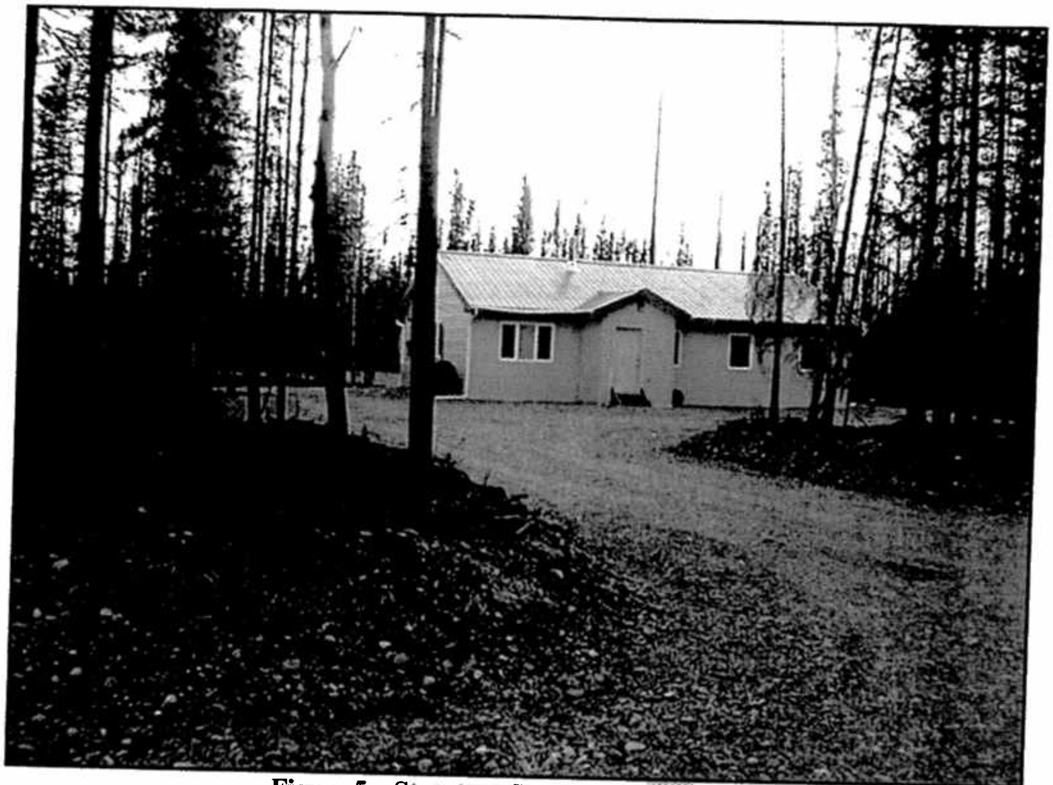


Figure 5 – Structure Saved – Red Fox Fire

Figure 6 - Structure Lost – Red Fox Fire

C. past and current prevention programs

During the debriefing of the 1990 Tok River Fire one of the issues was not being able to locate, existing structures in the area, or whom to contact for evacuations purposes. The solutions to this issue were to develop a Tok Forestry house database. This program started in the early nineties. Forestry used a mapping program from ESRI Arcview/GIS to input information collected from our Technicians and overlaid it on photos / maps. The information was then put into folders to be used by Initial Attack Firefighters and in all phases of fires. It has been used for all major fires since as well as the earthquake. Other areas of the state have incorporated a similar program.

In an effort to reduce the amount of human caused fires in the area, Tok Forestry allows landowners to bring their brush to a gravel pit where engine crews burn it. This program has been very successful and is expected to continue. When issuing burn permits, firefighters inspect the site and offer to provide a firewise assessment while on location.

III. Fuel Reduction Collaboration

Taking a look into the past fire history, and the remaining fuels left, Tok will burn unless something is done to minimize the hazard. The hazard fuel reduction program began in 2003 with the assistance of Fish and Wildlife. With their assistance, and an urgent need to identify other areas of concern, we began to develop this plan. We contacted other State and Federal agencies, including BLM, Tetlin Wildlife Refuge, DOT, AST, and representatives of the school district. Input was received from the Tok Fire Department, Fish and Game and lifelong members of the community of Tok during a meeting at Fast Eddy's on 2/20/07. The second meeting was conducted at Fast Eddies on 3/29/07 with Alaska Village Initiative, and representative form Tanacross Village, and Tok Chamber of Commerce present.

The Tok Area Forester, Jeffery Hermanns, and Jim Folan, the Area Prevention Technician, had many one-on-one meetings with members of the community.

Figure 7 - Homes lost to Wildland Urban Interface (WUI) fire

IV. Wildland Urban Interface (WUI)

The Wildland Urban Interface (WUI) is the area where houses meet or intermingle with undeveloped wildland vegetation. Communities within the WUI face significant risk to life property and infrastructure. Wildland fire within the WUI is one of the most difficult, dangerous, and complicated situations firefighters face. Joint fire planning places a priority on working collaboratively within the community to reduce the risk of wildfire. Methods of reducing the risk of wildfire within the WUI include:

- Reducing the amount of fuels within the interface area;
- Fragmenting or breaking up continuous hazard fuels;
- Reducing the incidence of human caused fires;
- Involving individual landowners in implementing Firewise program measures on their own property.

Wildland firefighting agencies and local fire departments cannot always adequately protect the growing number of structures, especially in the sprawling wildland urban interface areas or where developments are remote or hidden within the wildlands. *It is therefore critical that landowners assume responsibility for protecting their property against wildfire to the best of their ability.*

Figure 8 - House that survived the Red Fox Fire

V. Fire Policies and Programs

A. Fire Management Plan

The Alaska Interagency Wildland Fire Management Plan (AIWFMP) was developed by the Alaska Interagency Fire Management Council to provide a coordinated and cost effective approach to fire management to all lands in Alaska. All fire management decisions by land managers and owners are based on values warranting protection, protection capabilities, firefighter safety, and or land resource management needs. Before the plans were developed existing strategy called for suppression of all wildfires. The AIWFMP requires all land managers review the fire protection needs on lands under their management authority. The fire protection levels are Critical, Full, Modified or Limited management options. The options selections are based on land manager's values to be protected as well as land and resource management objectives. The categorization and prioritization ensures that human life, private property, and identified resources receive an appropriate level of protection with the available firefighting resources. All of the areas within Phase I of the CWPP are classified as Critical where aggressive initial attack of all fires is required.

B. Definition of Fire Protection Levels

■**Critical Protection** - Suppression action provided on a wildland fire that threatens human life, inhabited property, designated physical developments, and structural resources such as those designated as National Historic Landmarks. The suppression objective is to provide complete protection to identified sites and control the fire at the smallest acreage reasonably possible. The allocation of suppression resources to fires threatening critical sites is given the highest priority.

■**Full Protection** - Suppression action provided on a wildland fire that threatens uninhabited private property, high-valued natural resource areas, and other high-valued areas such as identified cultural and historical sites. The suppression objective is to control the fire at the smallest acreage reasonably possible. The allocation of suppression resources to fires receiving the full protection option is second in priority only to fires threatening a critical protection area.

Modified Protection - Suppression action provided on a wildland fire in areas where values to be protected do not justify the expense of full protection. The suppression objective is to reduce overall suppression costs without compromising protection of higher-valued adjacent resources. The allocation of suppression resources to fires receiving the modified protection option is of a lower priority than those in critical and full protection areas. A higher level of protection may be given during the peak burning periods of the fire season.

Limited Protection - Lowest level of suppression action provided on a wildland fire in areas where values to be protected do not justify the expense of a higher level of protection, and where opportunities can be provided for fire to help achieve land and resource protection objectives. The suppression objective is to minimize suppression costs without compromising protection of higher-valued adjacent resources. The allocation of suppression resources to fires receiving the limited protection option is of the lowest priority. Surveillance is an acceptable suppression response as long as higher valued adjacent resources are not threatened.

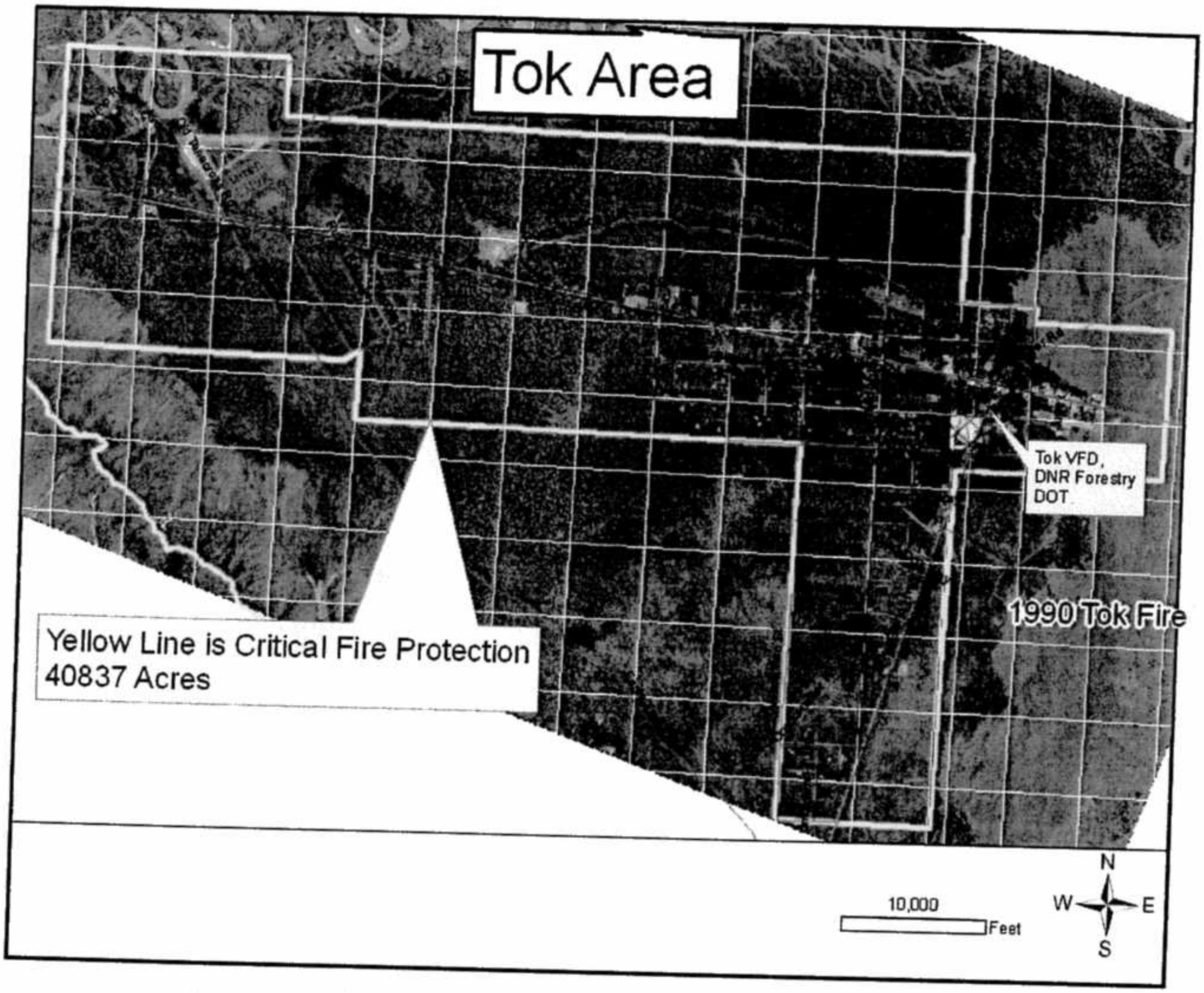


Figure 9 - Map of Tok Showing critical management area

C. Fire Ecology and Silvicultural.

Prior to 1950 fires were allowed to burn across the landscape. The acreage burned by these fires depended on the fuel bed and fire weather. The result was a vast diversity of forest age classes in a mosaic thrown over the landscape. When wildfires burn an area it kicks the forest back succession ally to age zero. Forest succession has been happening for as long as forests have existed in Alaska. The result is site conversion from white and black spruce to hardwoods and willows. Immediately following the fire, the site begins to warm due to the removal of the forest canopy, consumption of insulating moss, and the blackening of the forest floor which increases warming from the sun. This warming cycle significantly increases the nutrient recycling. The warmed burnt area, rich in nutrients, becomes an ideal environment for the growth of pioneering forest species such as birch, aspen and willow.

Because new succulent growth is rich in nutrients, the new forest becomes a major food source for a vast diversity of wildlife, from voles and foxes to moose and wolves.

After about thirty years the hardwood forest canopy begins to close in and the increased shade provides an environment conducive to establishment and growth of conifers, both white and black spruce. The forest floor is further cooled and insulating moss layers begin to develop. Due to this cold environment, pioneering species of hardwoods and willows begin to die and are gradually replaced by spruce. The habitat value and diversity of wildlife are greatly diminished. The succession of forest back to spruce takes 80- 100 years. The process is then starts all over again when lightning strike starts a new fire.

With the start of fire fighting in 1950, the natural fire cycle and the creation of a diversity of forest age classes across the landscape was slowed. Occasional fires escaped suppression and large fires would result, but overall the forest grew older as a whole. The forest tended to be one age with a lack of diversity. The overall forest health had diminished. Continuous fuel beds were created, leading to more difficult fire suppression, With nature's tendency to do things on a large scale, this can create a fire that would burns much larger areas and hotter, thereby sterilizing the soil.

The goal of silvicultural is to manage forested lands, in this case, to break up the fuel beds, creating mix stand tree species and a safer environment.

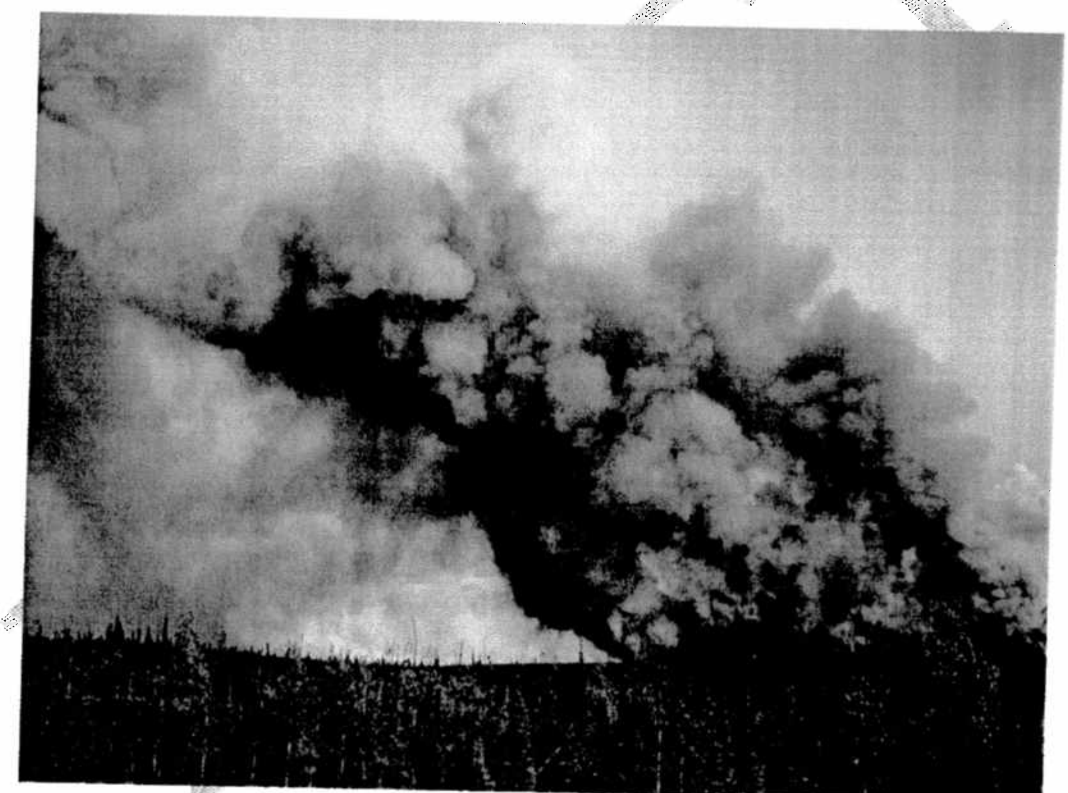


Figure 10 -Chicken Fire

VI. Assessment to Prioritize Areas for Fuel Reduction

The hazard fuel areas were identified using a combination of 2005 Digital Globe satellite imagery, Geographic Information Systems (GIS), 2007 site visits by wildland firefighters aerial reconnaissance, and community input. The assessment process will continue as mitigation efforts take place. It is hoped that 1000 acres or more can be treated each season. The total area of continuous hazard fuel around, and within Tok, is 38,000 acres.

VII. Community Profile

WUI Boundary

For the purposes of this plan, the Tok WUI boundary is considered to be the area immediately surrounding the town that inherits the Critical Fire Management Option, extending to Mile Post 1324 to the west of Tok. The area of Tok that falls within the Critical Management Option Plan is approximately 62 square miles.

A. Location and General Geographic Location

Tok is located at approximately mile 1314 of the Alaska Highway, where it intersects with the Tok Cutoff. The community lies at approximately: Latitude: 63.32 N, Longitude: 143.02 W; T18N, R13E, Sec 18, Copper River Meridian) Elevation 1632'

C. Population

The 2000 U.S. Census estimates the population of Tok at 1,393. The State Demographer estimates the 2004 population as 1,439. During the peak wildfire season there are usually hundreds of travelers and tourists in the area.

D. Structures

During the 2000 U.S. Census, total housing units numbered 748, and vacant housing units numbered 214. Vacant housing units used only seasonally numbered 66. Emergency services will need to identify which houses are occupied and which are not in order to avoid confusion during an emergency. There are numerous businesses both on the highways and secondary roads.

E. Infrastructure

Tok is approximately 350 miles from Anchorage and 200 miles from Fairbanks. Tok a critical transportation hub being situated at the intersection of the Alaska Highway and the Tok Cutoff. ***All* supplies (including food and fuel), and Travelers that enter or leave the State by road** must pass through Tok. Highways are subject to road closures when wildfire threatens the highway. This could have serious consequences for the entire state. Limited supplies could also impact fire suppression activities. When highways are threaten it also threatens the corridors. Corridors easements are used for power and telephone lines, and a proposed natural gas pipeline to the Lower-48. We all depend on the uninterrupted service these lines provide. Other villages are soon to be hooked up with power originating from Tok.

Tok has several communication towers including the U.S. Coast Guards LORAN Station (Long Rang Aid to Navigation), which is 6 miles east of Tok, The states network tower located behind DOT, and TV Tower located east of downtown.

There are two State owned runways in Tok. One is a gravel strip operated by DNR and is 1,690' long by 45' wide (Tanacross). The other is an asphalt runway operated by DOT and is 2,509' long and 50' wide (Tok). There are several private airstrips in the community. Smoke generated by a wildfire can affect Medivac flights when required for major medical cases, as well as retardant drops were needed.

F. Industry

A large segment of the population of Tok is employed in government or the service/tourism industry. Tok is a natural stopping point on the highway for travelers and there are over two hundred motel rooms in Tok and several bed and breakfasts, RV Parks, Gas Stations, and repair shops located within the community.

There are several logging mills in the area with a healthy demand for firewood and house logs.

G. Subsistence

A large number of people in Tok and the surrounding area rely on subsistence, especially moose. Active forest management, including hazard fuel reduction, will improve moose habitat while improving the overall health of the forest.

Figure 11 - Tok Fire Dept. Engine Filling a Forestry Engine During 2004 Chicken Fire

Figure 12 -Smoke over Alaska- August 14, 2005 – Earth Observatory

VIII. Community Risk Assessment

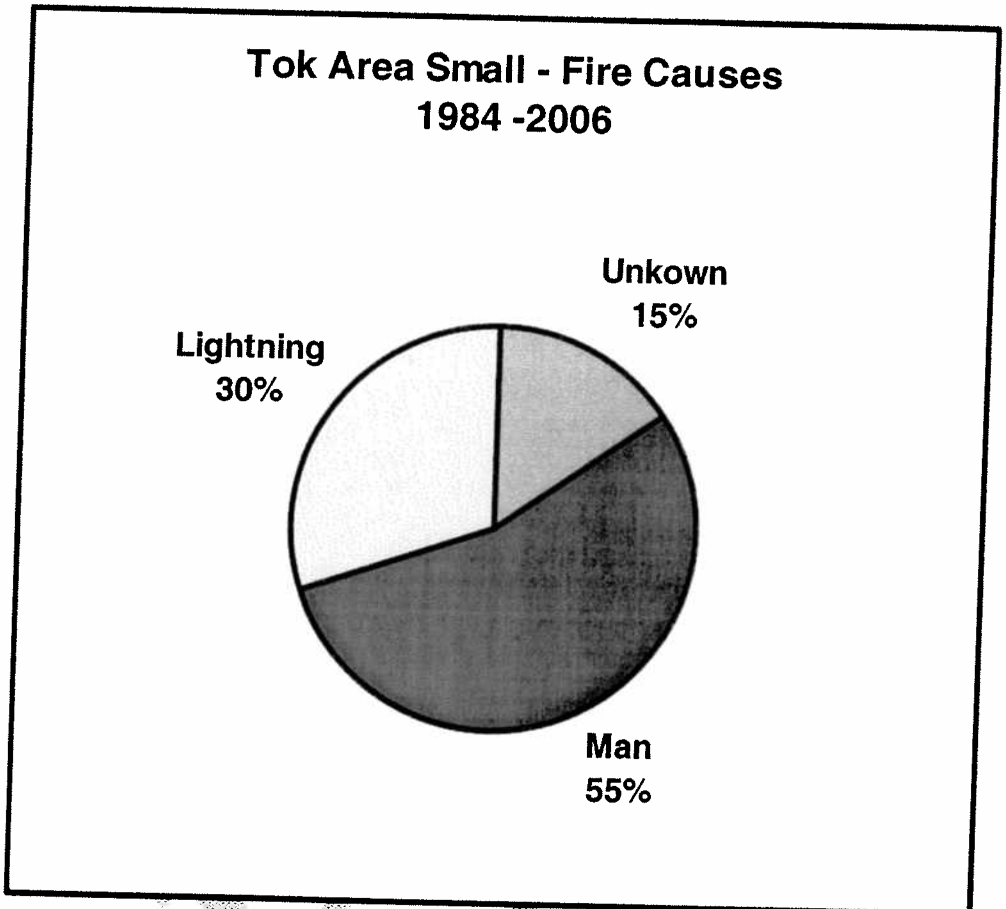


Table 1 - Small Fire Causes

B. Hazards

1. Hazard Fuel

Hazard fuels consist of living and dead burnable plant materials that foster or promote the ignition, spread or increase the intensity of a wildland fire that would threaten the safety of people or property. Most of the area on the outskirts of Tok has a hazardous amount of stunted or mature white spruce. Much of it is "dog hair" or spruce that is 2-4 inches diameter breast height (DBH), and tightly packed, with some large spruce mixed in. This type of forest provides a fuel to air ratio for a dangerous wild fire that is difficult to control (much like grass, only on a larger scale). Large tracts of land to the North, West and Southwest of Tok contain this type of fuel creating the threat of a large fire moving towards the community. With only a few trails into these areas, they are difficult to access and firefighters would have few options if a forest fire were to approach from any of these directions.

2. Hazard Fuel Mixed With Structures

Most subdivisions or neighborhoods in Tok contain the same type fuels as mentioned above. These neighborhoods are sparsely populated and many have undeveloped lots between homes. The "House Locater" project conducted by Forestry in the late 1990s revealed that the vast majority of homes in

Tok would not survive a wildfire if left unattended. With limited resources and the possibility of a wind driven fire quickly overwhelming what resources are available, whole subdivisions could be burnt to the ground.

3. Ingress/Egress

Most secondary roads as well as the Alaska Highway also have these fuels on both sides of the road making ingress or egress potentially dangerous. Many families live near the end of long roads with only one way in or out. This would make it difficult for people to evacuate in the event of a serious fire. It would also be dangerous for firefighters to attempt to protect the structures or assist in evacuations. Lack of an effective evacuation plan or notification system exacerbates this problem. Many of the fatalities that occurred during the 1991 Oakland Fire were the result of people becoming entrapped in their vehicles as they tried to flee the firestorm.

4. Hazardous Materials

Many homes in Tok have above ground fuel storage tanks for home heating oil and propane; some also have above ground gasoline tanks for their vehicles. These are particularly hazardous due to the volatile nature of gasoline and the typical location of the tanks (usually near the optimum parking spot for a fire engine). Greenhouses, garages, and sheds typically contain chemicals and other types of haz-mat and incendiary chemicals. Abandoned vehicles are also a hazard to firefighters.

5. Tourists and Travelers

As mentioned earlier, Tok is an important junction, but it is also an international border town and as such, has a number of issues that come with this designation. One issue is transients that are unable to cross the border and are forced to camp in Tok. It is also a natural stopping point for people who have traveled a long distance through a foreign country. In addition to the junction that leads to Anchorage and Fairbanks, Tok is also the jumping off point for folks who travel the Taylor Highway. There are numerous campgrounds and gravel pits in the area that these travelers use to camp and build warming/cooking fires.

6. Lack of Government

While this plan does not propose to form a government, Tok does not have a formal government and no tax base. As such it also has no formal parcel base to help locate landowners, or fund full time Fire Department personnel.

C. Barriers

Barriers are natural or manmade zones that block or restrict the movement of a wildfire. Natural barriers can be rivers, lakes, ridges, rocky areas, and non- flammable vegetation. Manmade barriers include roads, airstrips, or areas where flammable vegetation has been removed. The Tok River burn scar provides a natural barrier against wildfire to the East of Tok, and the Red Fox fire, in conjunction with the Red Fox fuel reduction project provides a barrier against a wildfire approaching from the . This barrier is not in itself adequate until it is expanded. The roads and highways in this community are not adequate barriers to a wind driven fire.

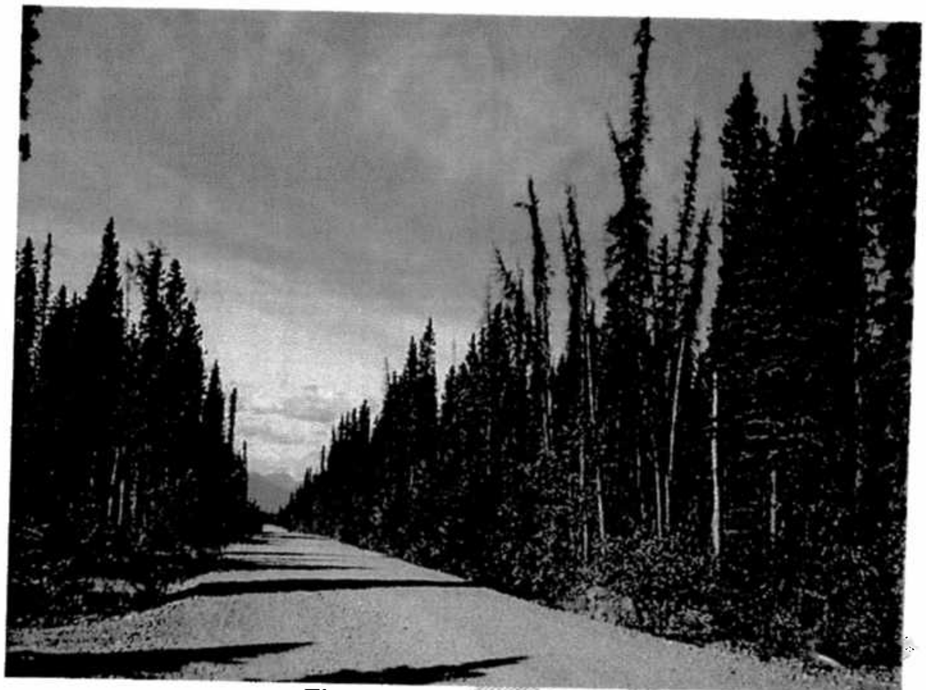


Figure 13 - Red Fox Drive

Figure 14 Red Fox 2001

IX. Hazard Mitigation

A. Goals and Objectives

The number one responsibility of the government is the safety and health of the people.

The primary goal of the CWPP is to reduce the risk of wildfire to the community of Tok and its essential infrastructure. The following is a list of objectives proposed to reduce the risk of wildfire in the community.

Objective #1: Develop a Hazard Matrix and Map that Identifies Areas at Risk

DOF will conduct hazardous fuels mapping using GIS and satellite imagery. With this map, a plan can be developed that will allow Forestry to remove hazard fuels in the most cost effective way and provide for public and firefighter safety. This map will be updated to show progress and to allow for flexibility within the plan.

Objective #2: Develop a CWPP

Public meetings will be held to solicit comments from people within the community. These meetings should, include community leaders, organizations, and other agencies on their concerns and priorities regarding wildfire risks and projects to reduce that risk. Utilizing this input, a draft CWPP will be built for final approval from the community, and submitted in early spring of 2007. Progress will be monitored to insure long term success. Phase two of the plan will be submitted in spring of 2008 and will seek to improve on the plan and add sustainability.

Objective #3: Reduce Hazard Fuels within the Community

Hazard fuel reduction will provide the greatest risk mitigation to the community. Initial projects will consist of removal of all spruce trees in order to create a hardwood forest within the targeted area.

Initial steps have been taken to reduce hazard fuels within Tok by Tok Forestry and Fish and Wildlife - Tetlin National Wildlife Refuge. Beginning in 2004, and continuing through 2007, the agencies have begun removing fuel from the North side of Red Fox Road on the Northern edge of Tok. Nearly 100 acres of hazard fuels have been removed from the area. This program initially utilized several different methods for removing hazard fuels. This included: 1. hand thinning to create a shaded fuel break (a method of removing most small trees and ladder fuels but leaving behind larger spruce and hardwoods). This spacing of 10-30 feet apart to creates a healthy, shaded spruce forest that will not sustain a crown fire). 2. Thinning with a feller buncher and heavy equipment to create a shaded fuel break, and **stand conversion** (Removal of all spruce trees and disturbing the forest floor to expose the soil, allowing willows, balsam poplar and quaking aspen to take seed, thereby starting the cycle of hardwoods to spruce then back to hardwoods), using a feller buncher and heavy equipment. Of these methods, stand conversion using heavy equipment is becoming the preferred method due to its relatively low cost and effectiveness.

Another method being planned is utilizing volunteers to be permitted to access 1-10 acre lots for removal of standing green and dead spruce in hazard fuel areas. This method allows forestry to remove fuels in a cost effective manner while allowing members of the community to obtain firewood and participate in fuel reduction. Forestry will also utilize its timber sale program to help in the removal of mature timber.

This plan proposes stand conversion on the outskirts of Tok and within the community itself where land status allows, and shaded fuel breaks within the community where stand conversion is impractical due to land status or other considerations. This fuel reduction will take place primarily on state lands, utilizing easements and right of ways and in some cases removing fuel from large parts of sections. Removing fuel from section lines will also provide access to firefighters responding to fires in areas that were previously inaccessible.

Another method being planned is utilizing volunteers to be permitted to access 1-10 acre lots for removal of standing green and dead spruce in hazard fuel areas. This method allows forestry to remove fuels in a cost effective manner while allowing members of the community to obtain firewood and participate in fuel reduction.

Fuel reduction on Red Fox. February 2007

Objective#4: Support and Encourage the Use of Firewise Programs

The first line of defense against a wildland fire is to create a Firewise landscape around your home and to construct your home to Firewise standards. Fire breaks around the outskirts of the community and even within the community will not protect against all wildfires and resources are quickly stretched thin during a WUI fire. Only in conjunction with landowners will this plan succeed. Tok Forestry will be updating its House Locater Book in 2007. We will offer advice and literature on defensible space and other Firewise tactics.

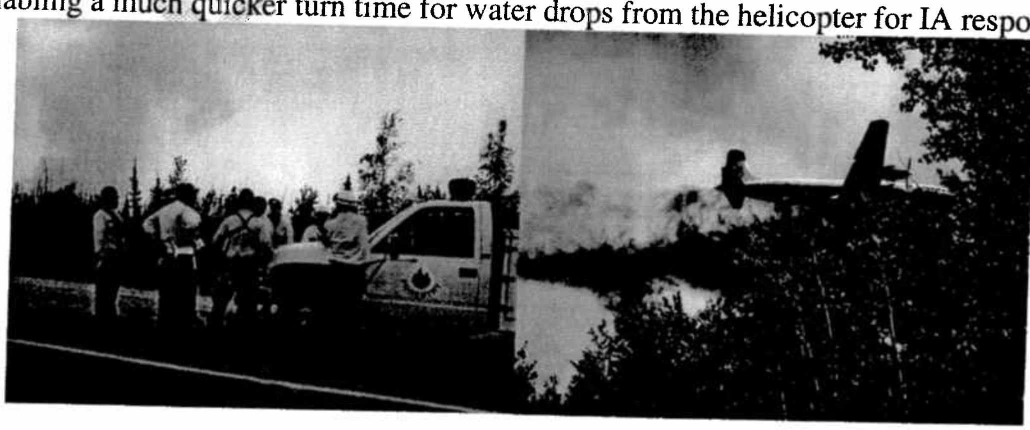
Objective #5: Build an Evacuation Plan

A revised evacuation plan is needed along with primary evacuation routes identified and improved to provide the public with a safe means to escape a wildfire. Also a communication system to allow for better and timelier notification in the event of an emergency. Emergency shelters needs to be identified, approved, and the plan exercised with cooperating agencies on an annual basis to ensure its effectiveness.

Tok does not have a local police force, relying instead on the State Troopers for law enforcement. This limits law enforcement capabilities in regards to emergency evacuation.

Objective # 6: Improve Firefighter Effectiveness through Use of Technology, Interagency Cooperation and a review of current and needed additional resources.

Increasing the use of satellite imagery and GIS data to provide the firefighter with better maps and data will enable them to improve their response time and success rate on Initial Attack fires while greatly increasing the effectiveness of the firefighters during large fires. Working with cooperating agencies to utilize this data and exercising these skills on a regular basis will help to minimize the confusion inevitably created during WUI fires. A critical review will be conducted of current and needed additional area resources to increase IA success. For example: a lack of water dip sites for a helicopter currently exist in the Tok area in several important areas. Dip sites could be constructed with wells installed enabling a much quicker turn time for water drops from the helicopter for IA response.



Objective #7: Build the CWPP to be Sustainable

It is in the best interest of the community of Tok to make the CWPP a sustainable plan. It is hoped that this can be done through increased use of contractors and members of the public to remove fuels and the use of those hazard fuels as energy or wood products. Phase Two of the CWPP will look to explore opportunities to use the wood and slash from the thinning projects for renewable energy, this should allow the project to be self sufficient while providing employment, inexpensive energy and improved wildlife habitat in the area.

B. Hazard Fuel Reduction Plan

Hazard Fuel Reduction Matrix - Tok

Priority	Area	Method
[illegible]	[illegible]	[illegible]
Medium	Evacuation Routes (Highways and Roads That Connect With Highways) Secondary Road Easements Private Property and State land Adjacent to Private Property	Hazard Fuel Removal By Hand Hazard Fuel Removal By Hand Hazard Fuel Removal – Thinning, Stand Conversion
Low	Easements, Section Lines, Large Areas Within Sections on Outskirts of Town	Stand Conversion by Mechanical Means

1. Obtain funding for the implementation of the Tok Community Wildfire Protection Plan- Phase 1

a. Specific hazardous fuels reduction projects Phase 1

- Remove hazardous fuels around the Tok School, DOT, DNR, and Tok Volunteer Fire Department - **145 acres**
- Remove or thin hazardous fuels adjacent to the Alaska Highway West 9 miles to Tanacross Airstrip – **54 acres**
- Remove hazardous fuels adjacent to critical ingress egress roads where possible, approximately 10 miles – **60 acres**

- Construct **4.5** mile extension of Fireweed road South To Eagle Trail with a 660' hazardous fuel break -- **360 acres**
- Construct a **3 mile** extension of Borealis Road, West to Fireweed Road with a 660' hazardous fuel break – **240 acres**
- Improve Fales Road, North of Schiovulli Road **.5 Miles** North to Alaska Highway and remove hazardous fuels 100' on West side – **6 acres**
- Remove hazardous fuels West of Fales Road for three miles – **240 acres**
- Construct a **3 mile** extension of Red Fox to the West with a 660' hazardous fuels break – **240 acres**
- Extend Mackenzie Trail to the North 4 miles to the Tanana River crossing with a 660' hazardous fuel break – **320 acres**
- Construct a fire lookout road and facility on top of Seven Mile Curve hills – **3 miles**
- Remove hazardous fuels from, and make Firewise, 3 Tok area State Parks Campgrounds – **60 acres**
- Improve power line easements – **280 acres**

b. Equipment, tools, materials and personnel required to implement the Tok CWPP.

- Full time Prevention Technician for DNR Tok Area Forestry.
- Community tree chipper and trailer.
- Dozer for the Tok Area Forestry to be used for Initial Attack, hazardous fuel reduction projects, fire breaks, forest roads and trails maintenance forest regeneration and wildlife enhancement projects.
- Road maintenance to firewood sales.
- 10 ton off road rubber track crawler with water tank for initial attack.
- Two community Water Warden Wagons
- Compressed Air Foam System (CAFS) for urban interface firefighting
- Two permanent Initial Attack helicopter dip ponds
- A seasonal fuel reduction crew that can double as a firefighting crew.

X. Summary

The community of Tok is in a unique and perilous situation in regards to wildfire. It has no significant topographical features such as hills to hinder fire suppression efforts, nor does it have a nearby body of water to be used as an effective resource by firefighters. **It <u>does have</u> a continuous hazard fuel load that encompasses nearly the entire town and areas immediately surrounding it.** This situation is conducive to a catastrophic wildfire that could threaten lives and property, possibly costing millions of dollars in damage. Residents of Tok are no strangers to wildfire. Many have been involved in firefighting efforts in some form or another, either by providing support, being employed as a firefighter, or, in some cases, actively fighting fire in their yards alongside firefighters. Lightning strikes are frequent during the summer months, and human caused fires typically occur during times when fire indices are at their highest. A good example of this is trees being blown into power lines on windy days. It is therefore widely recognized by the citizens of this community that given the right conditions, a destructive wildfire could occur that would quickly overwhelm firefighting capabilities. In light of this, the surest way to stop a wildfire of this magnitude is through fire prevention. Congress also recognizes this and has taken steps to correct the situation by enacting the Healthy Forests Restoration Act which President Bush signed into law on December 3rd 2003. This initiative directs communities at risk to

JEDC/Wood Products Development Service*
204 Siginaka Way
Sitka, AK 99835
Phone: (907) 747-5688
Fax: (907) 747-4331
E-mail: dparrent@ptialaska.net
Web site: http://www.jedc.org/wood

Wednesday, November 28, 2007

Jeff Hermanns
AK Div. of Forestry
P.O. Box 10
Tok, AK 99780

Dear Jeff:

Enclosed, please find a copy of my preliminary feasibility assessment for wood heating in the Alaska Gateway School District schools, as you requested. Please note that I made some mistakes in some of my financial calculations (hey, I'm just a forester), so please disregard the discussions of prevent value, net present value and internal rate of return. The numbers and discussion of simple payback is OK however.

If you have any questions, please feel free to drop me a note or give me a call.

Regards,

Dan Parrent

567-44

Daniel J. Parrent
Program Director, Wood Utilization Specialist

Enc.

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* *A Technical Assistance Service of the Juneau Economic Development Council in partnership with USDA Forest Service, USDA Rural Development and Alaska Department of Community and Economic Development*

Pre - Feasibility Assessment For High Efficiency, Low Emission Wood Heating In Tok, Dot Lake, Tanacross, Mentasta Lake, Tetlin and Northway

Draft Interim Report #2a

February 27, 2007

Prepared for:

Alaska Wood Energy Development Task Group

Prepared by:

Daniel Parrent,
Wood Utilization Specialist
Wood Products Development Service
Juneau Economic Development Council

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List of Tables and Figures

EXECUTIVE SUMMARY

The potential for heating Alaska Gateway School District (AGSD) facilities with high efficiency, low emission (HELE) wood-fired boilers in several communities is evaluated for the Alaska Wood Energy Development Task Group (AWEDTG).

Early in 2006, organizations submitted a Statement of Interest (SOI) to the Alaska Wood Energy Development Task Group (AWEDTG). Task Group members reviewed all the SOIs and selected projects for further review based on the selection criteria presented in Appendix A. Each AGSD facility was visited by AWEDTG representative(s) during the summer of 2006 and information was obtained for each facility. Preliminary assessments were made and challenges were identified. Potential wood energy systems were considered for each project using AWEDTG, USDA and AEA objectives for energy efficiency and emissions. Recommendations are made for each site.

SECTION 1. OVERVIEW

1.1 Goals and Objectives

- Visit AGSD facilities in Tok, Dot Lake, Tanacross, Mentasta Lake, Northway and Tetlin
- Assess the suitability of the facilities for siting a HELE wood-fired boiler
- Assess the type(s) and availability of wood fuels
- Size and estimate the capital costs of suitable HELE system
- Estimate the annual operation and maintenance costs of a HELE system
- Estimate the potential economic benefits from installing a HELE wood heating system

1.2 Evaluation Criteria, Project Scale and Operating Standards

- All projects meet the AWEDTG objectives for petroleum fuel displacement, use of hazardous forest fuels or forest treatment residues, use of local wood processing residues, sustainability of the wood supply, project implementation, operation and maintenance and community support

- The large energy consumers have the best potential for feasibly implementing a wood energy system and deserve detailed engineering analysis

- HELE wood systems are not feasible for very small (<500 gpy) applications. These may be satisfied with domestic wood appliances, such as wood stoves or pellet stoves/furnaces

- Systems consuming less than 2,000 gallons per year represent little or small savings with HELE wood systems unless they can be enclosed in an existing structure, wood is low cost, and labor is free

- Economic benefits may depend on low cost buildings and piping systems

- Efficiency and emissions standards for Outdoor Wood Boilers (OWB) will change beginning in October 2006 which will increase costs for small systems

1.3 Recommended Actions

1.3.1 Recommended Actions for the AGSD Offices in Tok

- The AGSD Office complex in Tok is the smallest of the AGSD facilities. The annual fuel consumption estimate is 4,000 gallons.

- The estimated required boiler capacity (RBC) to heat the AGSD Office complex is 174,000 Btu/hr during the coldest 24-hour period.

- At $3.00 per gallon and 4,000 gallons of fuel oil per year, the school district pays $12,000 per year for fuel oil. The HELE wood fuel equivalent of 4,000 gallons of fuel oil is 36 cords, and at $125/cord represents a gross annual savings of $7,500.

- A bulk fuel system is not feasible for the AGSD Offices but this facility could benefit from a small HELE cordwood system.

- Although the return/payback on small systems is marginal, further design and engineering for a small HELE cordwood system for the AGSD Offices is warranted.

1.3.2 Recommended Actions for the Dot Lake school

- The Dot Lake School is a "small" facility relative to the rest of the AGSD facilities. The annual fuel consumption estimate is 4,000 to 5,000 gallons.

- The estimated required boiler capacity (RBC) to heat the Dot Lake School is 198,000 Btu/hr during the coldest 24-hour period.

- At $3.00 per gallon and 4,500 gallons of fuel oil per year, the school district pays $13,500 per year for fuel oil. The HELE wood fuel equivalent of 4,500 gallons of fuel oil is 42 cords, and at $125/cord represents a gross annual savings of $8,250.

- A bulk fuel system is not feasible for the Dot Lake School but this facility could benefit from a small HELE cordwood system

- Although the return/payback on small systems is marginal, further design and engineering for a small HELE cordwood system for the Dot Lake School is warranted.

1.3.3 Recommended Actions for the Tanacross School

- The Tanacross School is a "small" facility relative to the rest of the AGSD facilities. The annual fuel consumption estimate is 5,000 to 6,000 gallons.

- The estimated required boiler capacity (RBC) to heat the Tanacross School is 250,000 Btu/hr during the coldest 24-hour period.

- At $3.00 per gallon and 5,500 gallons of fuel oil per year, the school district pays $16,500 per year for fuel oil. The HELE wood fuel equivalent of 5,500 gallons of fuel oil is 52 cords, and at $125/cord represents a gross annual savings of $10,000.

- A bulk fuel system is not feasible for the Tanacross School but this facility could benefit from a small HELE cordwood system

- Although the return/payback on small systems is marginal, further design and engineering for a small HELE cordwood system for the Tanacross School is warranted.

1.3.4 Recommended Actions for the Mentasta Lake School

- The Mentasta Lake School is a "medium-size" facility relative to the rest of the AGSD facilities. The annual fuel consumption estimate is 12,000 to 15,000 gallons.
- The estimated required boiler capacity (RBC) to heat the Mentasta Lake School is 650,000 Btu/hr during the coldest 24-hour period.
- At $3.00 per gallon and 13,500 gallons of fuel oil per year, the school district pays $40,500 per year for fuel oil. The HELE wood fuel equivalent of 13,500 gallons of fuel oil is 127 cords, and at $125/cord represents a gross annual savings of $24,625.
- A bulk fuel system is not feasible for the Mentasta Lake School but this facility could benefit from a small HELE cordwood system
- The return/payback on medium-size HELE wood systems is good. Further design and engineering for a medium-size HELE cordwood system for the Mentasta Lake School is warranted.

1.3.5 Recommended Actions for the Tetlin School

- The Tetlin School is a "medium-size" facility relative to the rest of the AGSD facilities. The annual fuel consumption estimate is 12,000 to 15,000 gallons.
- The estimated required boiler capacity (RBC) to heat the Tetlin School is 650,000 Btu/hr during the coldest 24-hour period.
- At $3.00 per gallon and 13,500 gallons of fuel oil per year, the school district pays $40,500 per year for fuel oil. The HELE wood fuel equivalent of 13,500 gallons of fuel oil is 127 cords, and at $125/cord represents a gross annual savings of $24,625.
- A bulk fuel system is not feasible for the Tetlin School but this facility could benefit from a small HELE cordwood system
- The return/payback on medium-size HELE wood systems is good. Further design and engineering for a medium-size HELE cordwood system for the Tetlin School is warranted.

1.3.6 Recommended Actions for the Northway School

- The Northway School is a "large" facility relative to the rest of the AGSD facilities. The annual fuel consumption estimate is 25,000 gallons.
- The estimated required boiler capacity (RBC) to heat the Northway School is 1,031,000 Btu/hr during the coldest 24-hour period. To achieve the capability to meet that demand would require the installation of two HELE cordwood boilers. However, the installation of a single 950,000 Btu/hr cordwood boiler could supply up to 92% of the RBC during the coldest 24 hour period and still realize a significant annual economic benefit. A bulk fuel system sized to 1.5 million Btu/hr (to meet 100% of the demand) is another option, although the capital costs associated with such a system is an "order of magnitude" higher than a cordwood system, and the fuel supply is not established.
- At $3.00 per gallon and 25,000 gallons of fuel oil per year, the school district pays $75,000 per year for fuel oil.
  - The HELE cordwood fuel equivalent of 25,000 gallons of fuel oil is 235 cords, and at $125/cord represents a gross annual savings of $45,625.
  - The bulk fuel equivalent of 25,000 gallons of fuel oil is 535 tons, and at $40 per ton represents a gross annual savings of $53,600

?

- A bulk fuel system may be marginally feasible for the Northway School; key financial metrics become positive after 20 years given certain assumptions, however . . .
- The return/payback on large HELE cordwood systems is very good. Further design and engineering for a medium-size HELE cordwood system for the Northway School is warranted.

1.3.7 Recommended Actions for the Tok School and Multi-Purpose Facility

- The Tok School and Multi-Purpose Facility (MPF) is the largest facility in the AGSD system. The annual fuel consumption estimate is 45,000 to 50,000 gallons.
- The estimated required boiler capacity (RBC) to heat the Tok School and MPF is 2,078,000 Btu/hr during the coldest 24-hour period. Although it may be technically possible to meet that demand by installing three large (950,000 Btu/hr) HELE cordwood boilers, it is unlikely to be practical. A bulk fuel system sized to 2.5 to 3 million Btu/hr is likely to be the better option, although the capital costs associated with such a system are high and the fuel supply is not established.
- At $3.00 per gallon and 48,000 gallons of fuel oil per year, the school district pays $144,000 per year for fuel oil. The bulk fuel equivalent of 48,000 gallons of fuel oil is 1,028 tons, and at $40 per ton represents a gross annual savings of $102,880.
- Given certain assumptions, a bulk fuel system appears feasible for the Tok School/MPF School and further investment in design and engineering is warranted.

SECTION 2. EVALUATION CRITERIA, IMPLEMENTATION, WOOD HEATING SYSTEMS

2.1 Evaluation Criteria

The AWEDTG selected projects for evaluation based on the criteria listed in Appendix A. All AGSD projects meet the AWEDTG criteria for fuel displacement, use of forest residues for public benefit, use of local residues, sustainability of the wood supply, project implementation, and operation and maintenance. In the case of cordwood boiler applications, the wood supply from forest fuels or local processing residues is adequate and matches the applications. In the case of bulk fuel boiler applications, the fuel supply is not well identified, although it is reasonably expected that the supply would develop commensurate with the demand.

2.2 Successful Implementation

In general, two aspects of project implementation have been important to wood energy projects in the past: clear identification of a sponsoring agency and dedication of personnel. In situations where several organizations are responsible for different community services, it must be clear which organization would sponsor or implement a wood-burning project. (NOTE: This is not necessarily the case with AGSD) Boiler stoking and/or maintenance is required for approximately 12-15 minutes several times a day (depending on the heating demand) for most manual systems, and dedicating personnel for the operation is critical to realizing savings from wood fuel use. And the cost of that labor cannot be overlooked. In Dot Lake, for example, the wood system was idle for a more than a year when an employee could not be found to stoke and maintain the boiler. For each project, it is assumed that personnel would be assigned as necessary and that "boiler duties" would fit into the responsibilities and/or job description of existing facilities personnel.

2.3 Classes of Wood Energy Systems

One of the objectives of the AWEDTG is to support projects that would use energy-efficient and clean burning wood heating systems, i.e., high efficiency, low emission (HELE) systems.

There are, basically, two classes of wood energy systems: manual cordwood systems and automated bulk fuel systems. Cordwood systems are generally appropriate for applications where the maximum heating demand ranges from 100,000 to 1,000,000 Btu per hour, although smaller and larger applications are possible. Bulk fuel systems that burn chips, sawdust, bark/hog fuel, shavings, etc., are generally applicable for applications where the maximum heating demand exceeds 1 million Btu per hour, although local conditions, especially fuel availability, can exert strong influences on the feasibility of a bulk fuel system.

Usually, an automated bulk fuel boiler is tied in directly with the existing oil-fired system. With a cordwood system, glycol from the existing oil-fired boiler system would be circulated through a heat exchanger at the wood boiler ahead of the existing oil boiler. A bulk fuel system is usually designed to replace 100% of the fuel oil used in the oil-fired boiler. Though it is possible for a cordwood system to be similarly designed, they are usually intended as a supplement, albeit a large supplement, to an oil-fired system.

In either case, the existing oil-fired system would remain in place and be available for peak demand or backup in the event of a failure or downtime in the wood system.

SECTION 3. THE NATURE OF WOOD FUELS

3.1 Wood Fuel Forms and Current Utilization

Wood fuels in the Tanana Valley are most likely to be in the form of cordwood and/or large, unprocessed sawmill residues, primarily slabwood.

Sawdust and planer shavings currently supply the limited demand for bulk fuel in the Tanana Valley. Other than sawdust and shavings, there is relatively little bulk fuel available, but this could change if the demand develops. There are several idle chippers located in the general area.

3.2 Wood Fuel Properties

Heating values for Alaska species are presented in Table 3-1. High Heating Values (HHV), which are calculated on an oven-dry (OD) basis, are similar for *most* species on a weight basis. Resinous species typically have higher HHV[1]. The recoverable heating value (RHV), which takes into account moisture content and other energy losses[2], ranges from 4,898 to 5,325 Btu/lb at 20 percent moisture content (MC20) and 3,358 to 3,678 Btu/lb at 40 percent moisture content (MC40), for species commonly found in the Tanana Valley (need data for aspen and black spruce).

Ideally, <u>cordwood</u> should be air dried to 20% moisture content (MC20), and one of the benefits of using cordwood is that the user may, with good planning, have the opportunity to realize a substantial economic benefit by buying it green and allowing it to dry. The RHV of white spruce (the most common species in the Tanana Valley) at MC20 is about 15.66 million Btu (MMBtu) per cord (assumed to contain 100 cubic of "fuel").

<u>Bulk fuels</u> (wood chips, sawdust, etc.) are generally used 'as delivered' from the producer with little opportunity for additional drying. Ideally, bulk fuels should contain 40% water (MC40) or

less, on a wet weight basis (approximately 67% on a dry weight basis). Bulk fuels are usually traded on a weight (ton) basis and the price may be adjusted up or down to reflect the moisture content of the fuel. White spruce has a RHV of 7.36 million (MM) Btu per ton at MC40.

Table 3-1. Heating Values of Selected Alaska Species							
		Cordwood			Bulk Fuel (chips, sawdust, etc.)		
	HHV[1]	GHV[2]	RHV[2]		GHV[2]	RHV[2]	
SPECIES	Btu/lb (MC0)	Btu/lb (MC20)	BTU/lb (MC20)	MMBtu per cord[b]	Btu/lb (MC40)	Btu/lb (MC40)	MMBtu per ton
Alaska yellow-cedar	9,900	7,920	6,101	20.30	5,940	4,260	8.52
Western redcedar	9,144[a]	7,315	5,520	13.51	5,486	3,824	7.65
Western hemlock	8,515[a]	6,812	5,037	16.86	5,109	3,462	6.92
Sitka Spruce	8,100	6,480	4,718	13.88	4,860	3,223	6.45
White Spruce	**8,890**	**7,112**	**5,325**	**15.66**	**5,334**	**3,678**	7.36
Red Alder	7,995[a]	6,396	4,638	13.67	4,797	3,163	6.33
Paper (white) birch	8,334	6,667	4,898	18.90	5,000	3,358	6.72
Quaking aspen							
Black cottonwood	8,800	7,040	5,256	12.99	5,280	3,626	7.25
Black Spruce							

Notes:

HHV= Higher Heating Value, from *Fuelwood Characteristics of Northwestern Conifers and Hardwoods*
GHV = Gross Heating Value = HHV x (1-MCwb/100). MCwb = percent moisture content calculated on a wet basis
RHV = Recoverable Heat Value = GHV – Energy Losses (see Appendix B)
[a] average of published range of values[1]
[b] a cord is assumed to contain 100 cubic feet of "fuel" (wood plus bark)

Most bulk fuel boilers operate well when fuel(s) contain less than 40% water (MC40) and poorly or very poorly if the moisture content is above 50%. In some areas, bulk fuels that are stored unprotected outdoors can absorb rainwater and reach moisture contents as high as 65%[3], so some consideration for dry storage may be appropriate. Schools in the northeast USA using wood chips select suppliers carefully and often pay a premium for chips below 40% MC[4].

3.3 Fuel Quality

Fuel quality, especially moisture content, has a large impact on the performance of wood-fueled boilers. For these assessments, it is assumed that cordwood has been seasoned and dried to 20% MC and bulk fuels average 40% water. Wetter fuel has lower heating values as shown in Table 3-2.

Table 3-2. Effect of Moisture Content on Gross Heating Value of White Spruce					
SPECIES	HHV Btu/lb Oven-dry (OD)	GHV Btu/lb (MC20)	GHV Btu/lb (MC30)	GHV Btu/lb (MC40)	GHV Btu/lb (MC50)
White spruce	8,890	7,112	6,223	5,334	4,445

Notes:

HHV= Higher Heating Value, from *Fuelwood Characteristics of Northwestern Conifers and Hardwoods* [1]
GHV = Gross Heating Value = HHVx (1-MCwb/100); MCwb is moisture content (wet basis) [2]

3.4 Recoverable Heat and Fuel Oil Equivalence/Displacement

Wood boilers are more expensive to install, own and operate than fuel oil boilers. Fuel cost savings (the difference between the cost of wood fuel and the cost of fuel oil) must pay for these higher investment and operating costs. The potential fuel oil displacement depends on the recoverable heating value (RHV) of the wood and the efficiency with which the boiler converts wood to energy (CE). Table 3-2 shows the potential amount of fuel oil displaced by wood at typical efficiencies with the heating values from Table 3-1. Wood system boiler conversion efficiency (CE) can be expected to vary from 35% for LEHE systems to 75% for HELE systems.

Deliverable heating value (DHV) is calculated using the equation:

DHV= RHV X CE [2]

Where DHV = Deliverable Heating Value
RHV = Recoverable Heating Value
CE = Conversion Efficiency

The fuel oil equivalence for white spruce bulk fuel (chips, sawdust) at MC40 is calculated at 46.7 gallons per ton at 70% conversion efficiency. The fuel oil equivalence for white spruce cordwood at MC20 in a HELE cordwood boiler is calculated at 106.4 gallons of fuel oil; more than twice as much as an LEHE boiler at 49.6 gallons per cord.

Table 3-2. Deliverable Heating Values and Fuel Oil Equivalence

Boiler and Fuel	RHV	CE	DHV[2]	Fuel Oil Equivalent (1 unit = X gallons)
Oil boiler, #2 Fuel Oil	138,000 Btu/gallon	80%	110,400 Btu/gallon	1gallon = 1 gallon
Wood chip boiler, white spruce, bulk wood fuel @ 40% MC	7.36 MMBtu/ton	70%	5.15 MMBtu/ton	1 ton = 46.7 gallons
HELE boiler, white spruce cordwood @ 20% MC	15.66 MMBtu/cord	75%	11.75 MMBtu/cord	1 cord = 106.4 gallons
LEHE boiler, white spruce cordwood @ 20% MC	15.66 MMBtu/cord	35%	5.48 MMBtu/cord	1 cord = 49.6 gallons

Notes:
RHV = Recoverable Heating Value
DHV = Deliverable Heating Value
HELE = High efficiency, low emission
LEHE = Low efficiency, high emission
MMBtu = million British thermal units

SECTION 4. WOOD-FUELED HEATING SYSTEMS

4.1 Cordwood Boiler Systems

4.1.1 Low Efficiency High Emission Wood Boilers

Most manual outdoor wood boilers (OWBs) that burn cordwood are relatively low-cost and save fuel oil but have been criticized for low efficiency and smoky operation. These could be called low efficiency, high emission (LEHE) systems and there are dozens of manufacturers. The State of New York recently instituted a moratorium on new LEHE OWB installations due to concerns over emissions and air quality[5]. Other states are also considering regulations[6,7,8,9]. Since there are no standards for OWBs ("boilers" and "furnaces" were exempted from the 1988 EPA regulations[10]) OWB ratings are inconsistent and can be misleading. Standard procedures for evaluating wood boilers do not exist, but test data from New York, Michigan and elsewhere showed a wide range of apparent efficiencies and emissions among OWBs.

In 2006, a committee was formed under the American Society for Testing and Materials (ASTM) to develop a standard test protocol for OWBs[11]. The standards included uniform procedures for determining performance and emissions. Subsequently, the ASTM committee sponsored tests of three common outdoor wood boilers using the new procedures. The results showed efficiencies of 35% to 40% and emissions **more than nine times** the standard for industrial boilers. Obviously, these results were deemed unsatisfactory and new standards began to be developed.

In a news release dated January 29, 2007[12], the U.S. Environmental Protection Agency announced a new voluntary partnership agreement with 10 major manufacturers to make cleaner-burning OWBs. The new standard calls for emissions not to exceed 0.6 pounds (272.16 grams) of particulate emissions per million Btu of heat input. Compared to EPA's 1988 emission standards for non-catalytic woodstoves of 7.5 grams (0.0165 lbs) of smoke per hour, and 4.1 g/h (0.009 lb/hr) for catalytic stoves (http://www.epa.gov/woodstoves/technical.html), this still seems quite liberal, but it's a step in the right direction.

To address local and state concerns over regulating OWB installations, the Northeast States for Coordinated Air Use Management (NESCAUM), and EPA have developed model regulations that suggest OWB installation specifications, clean fuel standards and owner/operator training. (http://www.epa.gov/woodheaters/ and http://www.nescaum.org/topics/outdoor-hydronic-heaters)

Implementation of the new standard will improve air quality and boiler efficiency but will also increase costs as manufacturers modify their designs, fabrication and marketing to adjust to the new standards. Some low-end models will no longer be available.

4.1.2 High Efficiency Low Emission Cordwood Boilers

In contrast to low efficiency, high emission (LEHE) outdoor wood boilers there are a few units that can rightly be considered high efficiency, low emission (HELE). These systems are designed to burn cordwood fuel cleanly and efficiently.

Table 4-2 lists three HELE boiler suppliers, two of which have units operating in Alaska. A Tarm gasification boiler is being used to heat a 5,000 square foot house in Palmer, AK.[13] Tarm USA supplies boilers from 100,000 Btu/hr to 198,000 Btu/hr maximum heat output and claims fuel to hot water efficiencies of 80%. A Garn boiler by Dectra Corporation is used in Dot Lake, AK to heat several homes and the washeteria, replacing 7,000 gallons per year (gpy) of #2 fuel oil.[14]

include others

Table 4-2. HELE Cordwood Boiler Suppliers		
	Btu/hr ratings	Supplier
EKO-Line	85,000 to 275,000	New Horizon Corp www.newhorizoncorp.com
Tarm	100,000 to 198,000	Tarm USA www.tarmusa.com/wood-gasification.asp
Garn	350,000 to 950,000	Dectra Corp. www.dectra.net/garn
Note: Listing of any manufacturer, distributor or service provider does not constitute an endorsement.		

Table 4-3 shows the results for a Garn WHS 1350 boiler that was tested at 157,000 to 173,000 Btu/hr by the State of Michigan using the new ASTM testing procedures, compared with EPA standards for wood stoves and boilers. It is important to remember that wood fired boilers are not entirely smokeless; even efficient boilers smoke for a few minutes on startup.[4,15]

Table 4-3. Emissions from Wood Heating Appliances	
Appliance	Emissions (grams/1,000 Btu delivered)
EPA Certified Non Catalytic Stove	0.500
EPA Certified Catalytic Stove	0.250
EPA Industrial Boiler (many states)	0.225
GARN WHS 1350 Boiler*	0.179
Source: Intertek Testing Services, Michigan, March 2006. Note: *Average efficiency of 75.4% based upon the higher heating value (HHV) of wood.	

Garn advertises efficiencies of 70+% for their WHS series from 350,000 to 950,000 Btu/hr heat output with heat storage capacities of 920,000 Btu to 2,064,000 Btu (120°F - 200°F). While other suppliers may develop models with similar performance, Tarm and Dectra/Garn units were used as the basis for this feasibility assessment[16].

Cordwood boilers are ideal for applications from 100,000 Btu/hr to 1,000,000 Btu/hr, although both larger and smaller applications are possible.

4.2 Bulk Fuel Boiler Systems

Commercial bulk fuel systems are generally efficient and meet typical federal (EPA) and state air quality standards. They have been around for a long time, and there is little new technological ground to break installing one. Efficient bulk fuel boilers typically convert 70% of the energy in the wood fuel to hot water or low pressure steam when the fuel moisture is less than 45% moisture content (MC), (calculated on a wet basis).

Most vendors provide systems that can burn various bulk fuels (wood chips, sawdust, wood pellets and hog fuel), but each system, generally, has to be designed around the predominant fuel form. A system designed to burn clean chips will not necessarily operate well on a diet of hog fuel, for example. And most vendors will emphasize the need for good quality wood fuel and a consistent source of wood fuel, i.e., fuel with consistent size and moisture content, from a common source is more desirable than variations in chip size or moisture content. Table 4-4 presents a partial list of bulk fuel boiler system vendors.

Table 4-4. Bulk Fuel Boiler System Vendors
Decton Iron Works, Inc Butler, WI (800) 246-1478 www.decton.com
Messersmith Manufacturing, Inc. Bark River, MI (906) 466-9010 www.burnchips.com
Chiptec Wood Energy Systems South Burlington, VT (800) 244-4146 www.chiptec.com
New Horizon Corp. Sutton, WV (877) 202-5070 www.newhorizoncorp.com
JMR Industrial Contractors Columbus, MS (662) 240-1247 www.jmric.com
Note: Listing of any manufacturer, distributor or service provider does not constitute an endorsement.

Bulk fuel systems are available in a range of sizes between 300,000 and 60,000,000 BTU/hr. However, the majority of the installations range from 1 MMBtu/hr to 20 MMBtu/hr. Large (relatively) energy consumers, like the Tok School/Multi-Purpose Facility (consuming 45,000 to 50,000 gallons of fuel oil per year) have the best potential for installing bulk fuel boilers and warrant detailed engineering analysis. Bulk fuel systems with their storage and automated fuel handling conveyances are generally not cost-effective for smaller applications.

Although there are several options, bulk fuel (chips, sawdust, bark, shavings, etc.) is best delivered in self-unloading tractor-trailer vans that hold about 22 to 24 tons of material. A facility such as the Tok School, replacing 48,000 gallons of #2 fuel oil with white spruce bulk fuel (MC40) would use an estimated 1,028 tons per year, or about 43 to 47 tractor-trailer loads spread out over the school year.

There are at least three bulk fuel boilers in Alaska (Table 4-5). The most recent was installed in Hoonah in 2006. A 4 MMBtu/hr chip boiler is under consideration for installation at the Craig Aquatic Center to replace 36,000 gallons of fuel oil per year. It is similar in size to boilers recently installed in Montana schools as shown in Table 4-6.

Table 4-5. Bulk Fuel Boilers in Alaska				
Installation	Boiler Horsepower*	MMBtu/hr	Heating Degree Days**	Supplier
Craig Aquatic Center Craig, AK	120	4	7,209[a]	Chiptek
Icy Straits Lumber & Milling Hoonah, AK	72	2.4	8,496[b]	Decton
Regal Enterprises Copper Center, AK	N/A	N/A	13,486[c]	Messersmith
Logging & Milling Associates Delta Junction, AK	N/A	2	12,897[d]	Decton

Notes:

* Heat delivered as hot water or steam. 1 Boiler Horsepower = 33,475 Btu/hr or 34.5 pounds of water at a temperature of 100°C (212°F) into steam at 212°F

** assumes base = 65° F

[a] NOAA, July 1, 2005 through June 30, 2006, Ketchikan data

[b] NOAA, July 1, 2005 through June 30, 2006, Average of Juneau and Yakutat data

[c] NOAA, July 1, 2005 through June 30, 2006, Gulkana data

[d] NOAA, July 1, 2005 through June 30, 2006, Big Delta data

ftp://ftp.cpc.ncep.noaa.gov/htdocs/products/analysis_monitoring/cdus/degree_days/archives/Heating%20degree%20Days/Monthly%20City/2006/jun%202006.txt

The investment cost of bulk fuel systems ranges from $500,000 to $2 million, with about $350,000 to $900,000 in equipment costs. Fuel handling and boiler equipment for an 8 MMBtu/hr (300 BHP) system was recently quoted to a school in the northeast USA for $900,000. A boiler and fuel handling equipment for a 3 to 4 MMBtu/hr systems is about $350,000 to $500,000. The 2.4 MMBtu/hr system in Hoonah was installed at a sawmill for $250,000, but an existing building was used and there were significant economies in fuel preparation and handling that would be unacceptable outside an industrial setting. Fuel and boiler equipment for a 1 MMBtu per hour system is estimated at $250,000 to $280,000 (buildings are extra). Several schools in New England have been able to use existing buildings or boiler rooms to house new equipment and realize substantial savings. The Montana projects are all in new buildings. Schools in Montana and New England that have installed bulk fuel systems save about half the total cost of fuel oil consumed per year.[4]

Table 4-6. Bulk Fuel Boilers in Montana Schools [4]				
Facility	Phillipsburg Public Schools	Darby Public Schools	Thompson Falls Public Schools	Victor Public Schools
Location	Phillipsburg, MT	Darby, MT	Thompson Falls, MT	Victor, MT
Heating Degree Days***	8,734	7,041	6,496	7,494
Project Cost *	$650,000	$650,000	$455,000	$628,991
Square Footage **	99,000	82,000	60,474	47,000
Peak Output (Btu/hr)	3,870,000	3,000,000	1,600,000	4,900,000
Annual wood fuel use (tons)	400	750	400	500
Fuel Replaced	Natural Gas	Fuel Oil	Fuel Oil	Natural Gas
Estimated Fuel Oil Use	NA	50,000 gal	24,000 gal	NA
Estimated annual fuel savings	$67,558 ($11 dkt)	$100,000 ($2.50/gal)	$60,000 ($2.50/gal)	$31,898 ($13.82/MMBtu)
Boiler Supplier***	N/A	Messersmith	Chiptek	Messersmith
Date Operational	01/05	11/03	10/05	09/04

Source: Montana Department of Natural Resource Conservation, http://dnrc.mt.gov
Notes:
* Darby cost excludes $268,000 in repairs to existing heat distribution system.
** Victor boiler sized to heat an additional 16,000 sq. ft. in future.
*** Additional data not supplied by Montana DNRC

Table 4-7 shows the total costs for the Darby School project at $1,001,000 including $268,000 for repairs and upgrades to the pre-existing system. Integration with any pre-existing system will require repairs and rework that must be included in the wood system cost. Adding the indirect costs of engineering, permits, etc. to the equipment cost puts the total cost at Darby between $716,000 and $766,000 for the 3 million Btu/hr system to replace 47,000 gallons of fuel oil per year. (NOTE: the Darby School is similar in fuel oil usage to the Tok School/MPF facility, although the heating degree days are quite different, which could impact boiler sizing.) Since the boiler was installed at Darby, building and equipment costs have increased from 10% to 25%. A new budget price for the Darby system might be closer to $800,000 excluding the cost of repairs to the existing system.[4]

The Craig Aquatic Center project was originally estimated at less than $1 million to replace propane and fuel oil equivalent to 36,000 gallons of fuel oil, but the results of a recent (January 2007) bid opening brought the cost estimate to $1.8 million. Building and system integration costs for the pool and two schools increased the project costs.

Table 4-7. Darby Public School Wood Chip Boiler Costs [4]	
Boiler Capacity	3 MMBtu/hr
Fuel Oil Displaced	47,000 gallons
Heating Degree Days	7,186
System Costs:	
Building, Fuel Handling	\$ 230,500
Boiler and Stack	\$ 285,500
Boiler system subtotal	\$ 516,000
Piping, integration	\$ 95,000
Other repairs, improvements	\$ 268,000
Total, Direct Costs	\$ 879,000
Engineering, permits, indirect	\$ 122,000
Total Cost	\$1,001,000
Source: Biomass Energy Resource Center, 2005 [4]	

SECTION 5. SELECTING THE APPROPRIATE SYSTEM

Selecting the appropriate heating system is, primarily, a function of heating demand. It is generally not feasible to install automated bulk fuel systems in/at small facilities, and it is likely to be impractical to install cordwood boilers at very large facilities. Other than demand, system choice can be limited by fuel (form) availability, labor, money, and limitations of the site.

The selection of a wood-fueled heating system has an impact on fuel economy. Potential savings in fuel costs must be weighed against initial investment costs and ongoing operating, maintenance and repair (OM&R) costs. Wood system costs include the initial capital costs of purchasing and installing the equipment, non-capital costs (engineering, permitting, etc.), the cost of the fuel storage building and boiler building (if required), the financial burden associated with loan interest, the fuel cost, and the other costs associated with operating and maintaining the heating system, especially labor.

5.1 Comparative Costs of Fuels

The major advantage of wood fuel compared to fuel oil is the cost of the fuel. Wood-fueled boilers are usually first installed where fuel is free or *very* low-cost. Typically, this means installations at sawmills and/or other wood processing facilities. On Prince of Wales Island in southeast Alaska, there are three low efficiency outdoor wood boilers that burn large mill residues (slabs, edgings, butt cuts and buck-outs) to heat buildings and dry kilns. In Hoonah, Dry Creek, and Kenny Lake bulk fuels (planer shavings, chips and sawdust) are burned in automated systems, again, to heat buildings and dry kilns.

Following installations at sawmills and woodworking plants, wood-fueled boiler installations are often feasible when installed in close proximity to free or low-cost fuel. Excess processing residues are often available at minimal cost at the mill/plant site. However, there is usually a cost associated with loading and transporting the fuel to the boiler installation. There are numerous such (OWB) installations in the Tanana valley and around the state.

Table 5-1 compares the cost of #2 fuel oil to white spruce bulk fuel (MC40) and white spruce cordwood (MC20). In order to make reasonable comparisons, all the variables must be taken into account, and costs must be reduced to cost per million Btu (MMBtu).

Table 5-1. Comparative Cost of Fuel Oil vs. Cordwood and Bulk Fuel

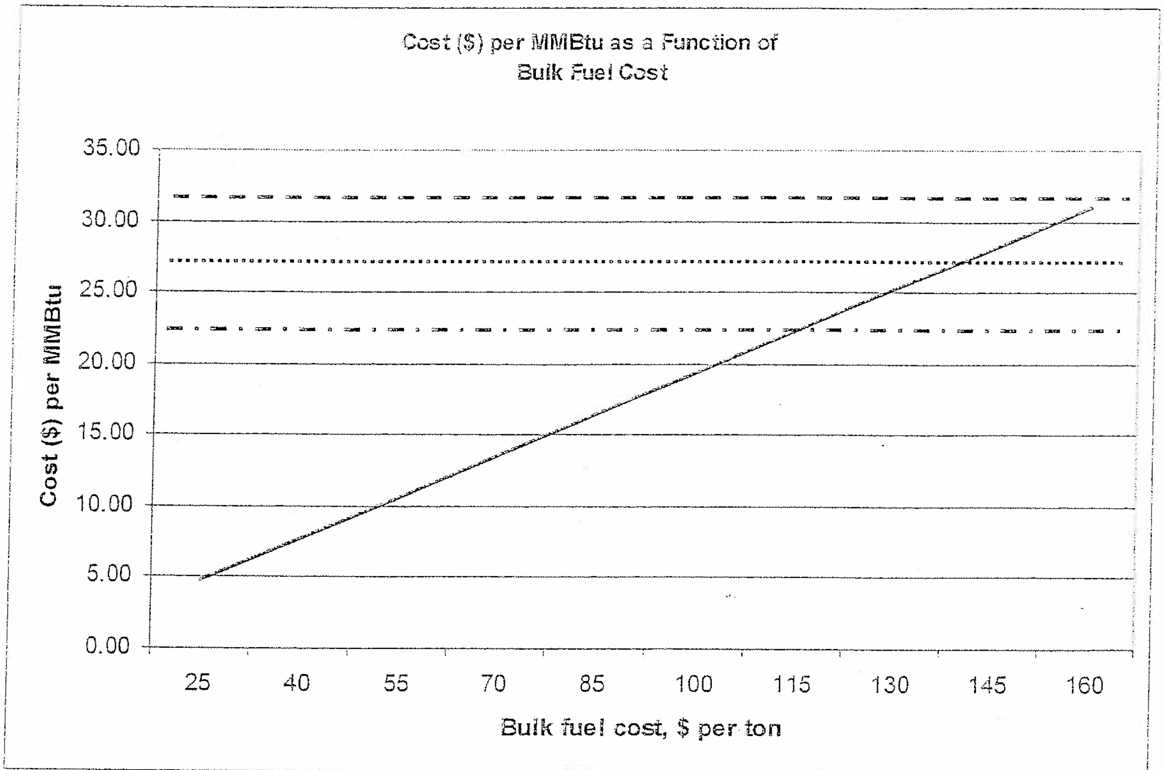
FUEL	RHV[a] (Btu)	Conversion Efficiency[a]	DHV[a] (Btu)	Price per unit ($)	Cost per MMBtu ($)
Fuel oil, #2, 1 gallon	138,000	80%	110,400	2.50/gal	22.65
				3.00	27.17
				3.50	31.70
White spruce, 1 ton, MC40	7,360,000	70%	5,152,000	30/ton	5.82
				40	7.76
				50	9.70
White spruce, 1 cord, MC20	15,660,000	75%	11,745,000	100/cord	8.51
				125	10.64
				150	12.77

Notes:
[a] from Table 3-2

5.1.1 Cost per MMBtu Sensitivity – Bulk Fuel

Figure 5-1 illustrates the relationship between the price of white spruce bulk fuel (MC40) and the cost of delivered heat, (the slanted line). For each $10 per ton increase in the price of bulk fuel, the cost per million Btu increases by about $1.94. The chart assumes that the bulk fuel boiler converts 70% of the RHV energy in the wood to useful heat and that fuel oil is converted to heat at 80% efficiency. The dashed lines represent fuel oil at $2.50, $3.00 and $3.50 per gallon ($22.65, $27.17 and $31.70 per million Btu respectively).

At high efficiency, heat from white spruce bulk fuel (MC40) at $116.70 per ton is equal to the cost of oil at $2.50 per gallon, before considering the investment and OM&R costs. At 70% efficiency and $40/ton, an efficient bulk fuel boiler will deliver heat at about 34% ($7.76 per MMBtu) of the cost of fuel oil at $2.50 per gallon, before considering the cost of the equipment and OM&R. Figure 5-1 shows that at a given efficiency, savings increase significantly with decreases in the delivered price of bulk fuel and/or with increases in the price of fuel oil.



Fuel Oil at $3.50 per gallon
Fuel Oil at $3.00 per gallon
Fuel Oil at $2.50 per gallon

Figure 5-1. Effect of White Spruce Bulk Fuel (MC40) Costs on Cost of Delivered Heat

5.1.2 Cost per MMBtu Sensitivity – Cordwood

Figure 5-2 illustrates the relationship between the price of white spruce cordwood (MC20) and the cost of delivered heat, (the slanted line). For each $10 per cord increase in the price of cordwood, the cost per million Btu increases by about $0.85. The chart assumes that the cordwood boiler converts 75% of the RHV energy in the cordwood to useful heat and that oil is converted to heat at 80% efficiency. The dashed lines represent fuel oil at $2.50, $3.00 and $3.50 per gallon ($22.65, $27.17 and $31.70 per million Btu respectively).

At high efficiency, heat from white spruce cordwood (MC20) at $266 per cord is equal to the cost of oil at $2.50 per gallon, before considering the cost of the equipment and OM&R costs. At 75% efficiency and $100/cord, a high-efficiency cordwood boiler will deliver heat at about 37.6% ($8.51 per MMBtu) of the cost of fuel oil at $2.50 per gallon. Figure 5-2 shows that at a given efficiency, savings increase significantly with decreases in the delivered price of cordwood and/or with increases in the price of fuel oil.

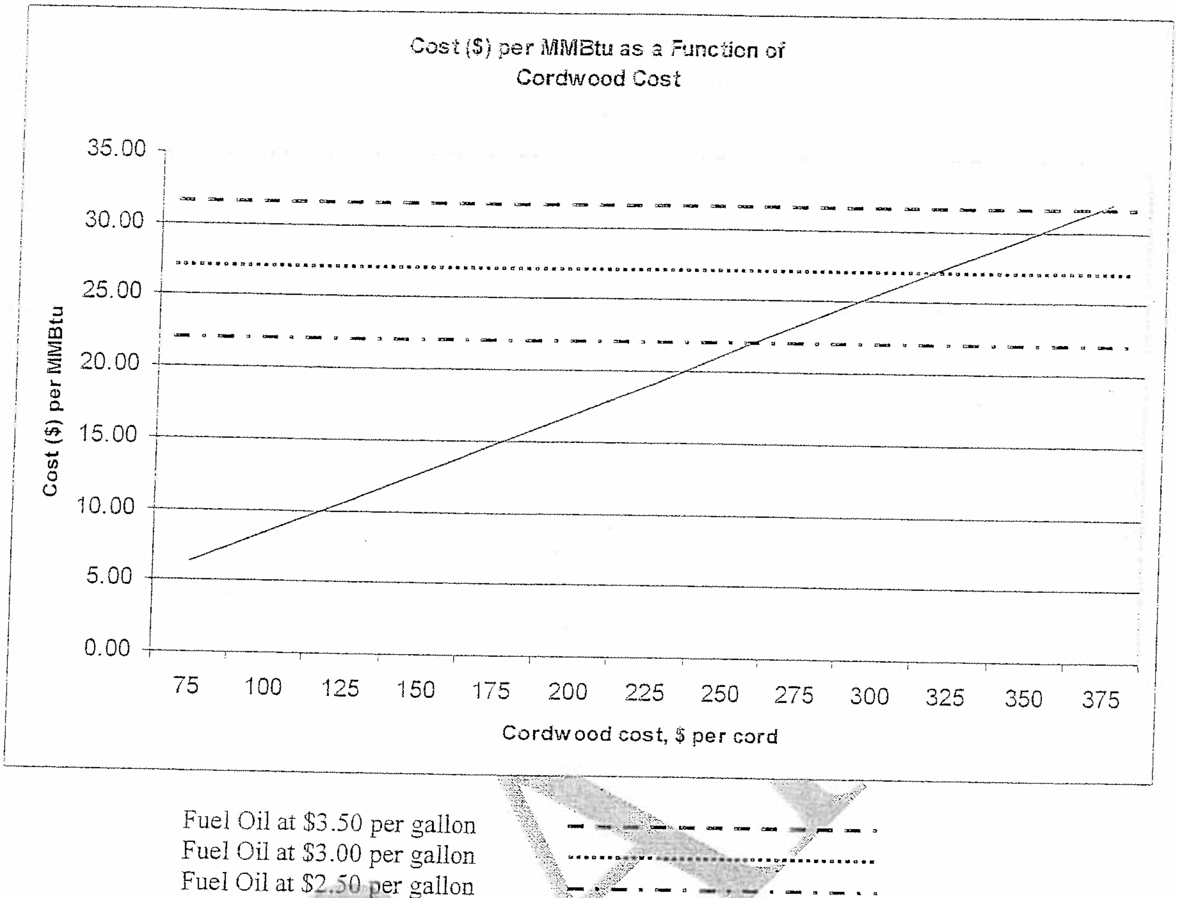


Figure 5-2. Effect of White Spruce Cordwood (MC20) Cost on Cost of Delivered Heat

5.2 Determining Demand

Table 5-2 shows the approximate amount of fuel oil used by each of the AGSD facilities annually. The smallest facility is the AGSD Offices, which consumes an estimated 4,000 gallons per year. This and the other AGSD facilities using 15,000 gallons per year (gpy) or less are best suited to cordwood boilers. The Northway School, at an estimated 25,000 gpy, could be served, technically, by either a large (or multiple) HELE cordwood boilers or a small bulk fuel boiler, depending on site-specific variables and financial considerations.

The largest facility is the Tok School and Multi-Purpose Facility (combined), consuming 45,000 to 50,000 gallons of fuel oil per year. Although it would not be out of the question to consider multiple large HELE cordwood boilers, this facility is probably best suited to a bulk fuel wood boiler.

Table 5-2. Estimated Annual Fuel Oil Consumption, AGSD Facilities		
AGSD Facility	Estimated Annual Fuel Consumption	
	Gallons	*Cost ($) @ $3.00/gallon*
AGSD Offices	4,000	12,000
Dot Lake School	4-5,000	12-15,000
Tanacross School	5-6,000	15-18,000
Mentasta Lake School	12-15,000	36-45,000
Tetlin School	12-15,000	36-45,000
Northway School	25,000	75,000
Tok School & MPF	45-50,000	135-150,000
TOTAL	**107-120,000**	**321-360,000**

Wood boilers, especially cordwood boilers, are often sized to displace only a portion of the heating load since the oil system will remain in place, in standby mode, for "shoulder seasons" and peak demand. Fuel oil consumption for each AGSD facility was compared with heating demand based on heating degree days (HDD) to determine the required boiler capacity (RBC) for heating only on the coldest 24 hour day (Table 5-3). This method matches well with bulk fuel boilers installed in schools across the country. While there are many factors to consider when sizing heating systems it is clear that, in all cases in this study, a wood system of less-than-maximum size could still replace a substantial quantity of fuel oil.

The calculations show that installed oil-fired heating capacity at most sites is 1½ to four times the demand for the coldest day. Manual HELE cordwood boilers, equipped with special tanks for thermal storage, can also supply heat at higher than their rated capacity for short periods. The 4,400 gallon storage tank at Dot Lake, for example, can store more than two million Btu which would be enough to heat the AGSD Offices on the coldest day for about 11½ hours (2,000,000 ÷ 174,000) [although you would probably not install such a large boiler for this facility], or the Northway School on the coldest day for nearly 2 hours (2,000,000 ÷ 1,031,000).

According to these calculations (Table 5-3) the AGSD Offices, Dot Lake School and Tanacross School could supply 100% of their heating needs of 174,000 to 250,000 Btu/hr with a Garn model WHS 1500 boiler rated at 350,000 Btu/hr. The Tetlin School and Mentasta Lake School (RBC = 650,000 Btu) could install a pair of Garn WHS 1500s or WHS 2000s (for a total of 700,000 or 850,000 Btu/hr), or a single Garn model WHS 3200 rated at 950,000 Btu/hr to meet their peak demands of 650,000 Btu/hr. The Northway School could come close (92%) to meeting its RBC (1,031,000 Btu/hr) with the installation of a single Garn model WHS 3200, or installing a pair of Garn model WHS 3200s rated at 950,000 Btu each to fully meet the peak heating needs.

The buildings at the Tok School and Multi-Purpose Facility have a total installed capacity of more than 8 times the estimated demand of 2.078 MMBtu/hr (due to multiple individual boiler installations, each of which is oversized). This suggests that a 2.5 to 3 MMBtu/hr boiler could replace all the oil used at this facility. The buildings are somewhat separated from one another, which increases piping costs and heating losses, but since the buildings are at the same elevation it is feasible to distribute heat to them from a single boiler. It may be technically possible to provide this much heat with a large, manual, HELE system (using multiple boilers), but due to the labor requirements to stoke the boilers, such an arrangement may not be practical. It is more likely that a bulk fuel system would be required.

Table 5-3. Estimate of Heat Required in Coldest 24 Hr Period

Facility	Fuel Oil Used gal/year[a]	Heating Degree Days[b]	Btu/DD[c]	Design Temp[d] F	RBC[e] Btu/hr	Installed Btu/hr[a]
AGSD Offices	4,000	13,486	34,918	-54	174,000	300,000
Dot Lake School	4-5,000	14,044	41,913	-48	198,000	354,000
Tanacross School	5-6,000	14,044	50,295	-54	250,000	600,000
Mentasta Lake School	12-15,000	13,486	130,941	-54	650,000	744,000
Tetlin School	12-15,000	13,486	130,941	-54	650,000	1,030,000
Northway School	25,000	14,044	209,565	-53	1,031,000	3,034,000
Tok School & MPF	48,000	13,486	419,012	-54	2,078,000	6,000,000 + 2,243,000

Table 3-7 Notes:

[a] From SOI and site visits

[b] NOAA, July 1, 2005 through June 30, 2006:
ftp://ftp.cpc.ncep.noaa.gov/htdocs/products/analysis_monitoring/cdus/degree_days/archives/Heating%20degree%20Days/Monthly%20City/2006/jun%202006.txt

[c] Btu/DD= Btu/year x oil furnace conversion efficiency (0.85) /Degree Days

[d] Alaska Housing Manual, 4th Edition Appendix D: Climate Data for Alaska Cities, Research and Rural Development Division, Alaska Housing Finance Corporation, 4300 Boniface Parkway, Anchorage, AK 99504, January 2000.

[e] RBC = Required Boiler Capacity for the coldest Day, Btu/hr= [Btu/DD x (65 F-Design Temp)+DD]/24 hrs.

5.3 Summary of Findings

Table 5-4 summarizes the findings so far: annual fuel oil usage, range of annual fuel oil costs, estimated annual wood fuel requirement, range of estimated annual wood fuel costs, and potential gross annual savings for each of the various facilities within the Alaska Gateway School District. [Note: potential gross annual savings do not consider non-fuel OM&R (operation, maintenance and repair) costs.]

Table 5-4. Estimate of Total Wood Consumption, Comparative Costs and Potential Savings

Facility	Fuel Oil Used gal/year[a]	Annual Fuel Oil Cost (@___ $/gal)			Wood Requirement[b]	Annual Wood Cost (@___ $/cord)			Potential Gross Annual Savings ($)		
POTENTIAL CORDWOOD SYSTEMS		*2.50*	*3.00*	*3.50*	White spruce, MC20, CE 75%	*100*	*125*	*150*	*Low*	*Medium*	*High*
AGSD Offices	4,000	10,000	12,000	14,000	36 cords	3,600	4,500	5,400	4,600	7,500	9,400
Dot Lake School	4,500	11,250	13,500	15,750	42 cords	4,200	5,250	6,300	4,950	8,250	11,550
Tanacross School	5,500	13,750	16,500	19,250	52 cords	5,200	6,500	7,800	5,950	10,000	14,050
Mentasta Lake School	13,500	33,750	40,500	47,250	127 cords	12,700	15,875	19,050	14,700	24,625	34,550
Tetlin School	13,500	33,750	40,500	47,250	127 cords	12,700	15,875	19,050	14,700	24,625	34,550
Northway School	25,000	62,500	75,000	87,500	235 cords	23,500	29,375	35,250	27,250	45,625	64,000
POTENTIAL BULK FUEL SYSTEMS					White spruce, MC40, CE 70%	*@$30/ton*	*@$40/ton*	*@$50/ton*			
Northway School	25,000	62,500	75,000	87,500	535 tons	16,050	21,400	26,750	35,750	53,600	71,450
Tok School & MPF	48,000	120,000	144,000	168,000	1,028 tons	30,840	41,120	51,400	68,600	102,880	137,160
Grand Total	114,000	285,000	342,000	399,000	619cds+1028tons Or 384cds +1563tons	92,740 85,290	118,495 110,520	144,250 135,750	140,750 149,250	223,505 231,480	306,260 313,710

NOTES:
a From Table 5-3; used the numerical average where a range was indicated
b From Table 3-2, Fuel Oil Equivalents

SECTION 6. FINANCIAL METRICS

Biomass heating projects are viable when, over the long run, the annual fuel cost savings generated by converting to biomass are greater than the cost of the new biomass boiler system plus the additional operation, maintenance and repair (OM&R) costs associated with a biomass boiler (compared to those of a fossil fuel boiler)

Converting from an existing boiler to a wood biomass boiler (or retrofitting/integrating a biomass boiler with an existing boiler system) requires a greater initial investment and higher annual OM&R costs than for an equivalent fossil fuel system alone. However, in a viable project, the saving in fuel costs (wood vs. fossil fuel) will pay for the initial investment and cover the additional OM&R costs in a number of years. After the initial investment is paid off, the project continues to save money (avoided fuel cost) for the life of the boiler. Since inflation rates for fossil fuels are typically higher than inflation rates for wood fuel, increasing inflation rates result in greater fuel savings and thus greater project viability.[17]

The potential financial viability of a given project depends not only on the relative costs and cost savings, but also on the financial objectives and expectations of the facility owner. For this reason, the impact of selected factors on potential project viability is presented using the following metrics:

- Simple Payback Period
- Present Value (PV)
- Net Present Value (NPV)
- Internal Rate of Return (IRR)

Total initial investment costs include all of the capital and non-capital costs required to design, purchase, construct and install a biomass boiler system in an existing facility with an existing boiler and steam or hot water distribution system.

6.1 Simple Payback Period

From: www.odellion.com:

The [Simple] Payback Period is defined as the length of time required to recover an initial investment through cash flows generated by the investment. The Payback Period lets you see the level of profitability of an investment in relation to time. The shorter the time period the better the investment opportunity:

$$\text{Payback Period} = \frac{\text{investment}}{\text{cash flow (year)}}$$

As an example, consider the implementation of a Human Resources (HR) software application that costs $150 thousand and will generate $50 thousand in annual savings in four years (the project duration):

HR Application Example

Initial	**Year 1**	**Year 2**	**Year 3**	**Year 4**
cost: $150K	benefit: $50K	benefit: $50K	benefit: $50K	benefit: $50K

Using the formula above, the Payback Period is calculated to be three years by dividing the initial investment of $150 thousand over the annual cash flows of $50 thousand. This equation is only applicable when the investment produces equal cash flows each year. Now consider the software implementation with the same initial cost but with variable annual cash flows:

HR Application Example

Initial	Year 1	Year 2	Year 3	Year 4
cost: $150K	benefit: $60K	benefit: $60K	benefit: $40K	benefit: $20K

Given the variable cash flows, the payback is calculated by looking at the cash flows and establishing the year the investment is paid off. At the beginning of Year 2, the company has recovered $120 thousand of the original $150 thousand. At the end of Year 2, the remaining $30 thousand is recovered with the cash flow of $40 thousand earned during this period. The payback period is then 2 + ($30 thousand/$40 thousand) or 2.8 years.

The Payback Period is a tool that is easy to use and understand, but it does have its limitations. Payback period analysis does not address the time value of money, nor does it go beyond the recovery of the initial investment.

6.2 Present Value

From: www.en.wikipedia.org:

The present value of a single or multiple future payments (known as cash flow(s)) is the nominal amounts of money to change hands at some future date, discounted to account for the time value of money, and other factors such as investment risk. A given amount of money is always more valuable sooner than later since this enables one to take advantage of investment opportunities. Present values are therefore smaller than corresponding future values. Present value calculations are widely used in business and economics to provide a means to compare cash flows at different times on a meaningful "like to like" basis.

One hundred dollars 1 year from now at 5% interest rate is today worth:

$$\text{Present value} = \frac{\text{future amount}}{(1 + \text{interest rate})^{\text{term}}} = \frac{100}{(1 + .05)^{1}} = 95.23.$$

6.3 Net Present Value

From: http://www.odellion.com:

The Net Present Value (NPV) of a project or investment is defined as the *sum* of the present values of the annual cash flows *minus* the initial investment. The annual cash flows are the Net Benefits (revenues minus costs) generated from the investment during its lifetime. These cash flows are discounted or adjusted by incorporating the uncertainty and time value of money. NPV is one of the most robust financial evaluation tools to estimate the value of an investment.

The calculation of NPV involves three simple yet nontrivial steps. The first step is to identify the size and timing of the expected future cash flows generated by the project or investment. The second step is to determine the discount rate or the estimated rate of return for the project. The third step is to calculate the NPV using the equations shown below:

$$NPV = \text{inital investment} + \frac{\text{Cash flow Year 1}}{(1+r)^1} + \dots \frac{\text{Cash flow Year n}}{(1+r)^n}$$

Or,

$$NPV = \text{inital investment} + \sum_{t=1}^{t=\text{end of project}} \frac{(\text{Cash Flows at Year t})}{(1+r)^t}$$

Definition of Terms

Initial Investment: This is the investment made at the beginning of the project. The value is usually negative, since most projects involve an initial cash outflow. The initial investment can include hardware, software licensing fees, and startup costs.

Cash Flow: The net cash flow for each year of the project: Benefits minus Costs.

Rate of Return: The rate of return is calculated by looking at comparable investment alternatives having similar risks. The rate of return is often referred to as the discount rate , interest rate, or hurdle rate, or company cost of capital. Companies frequently use a standard rate for the project, as they approximate the risk of the project to be on average the risk of the company as a whole.

Time (t): This is the number of years representing the lifetime of the project.

A company should invest in a project only if the NPV is greater than or equal to zero. If the NPV is less than zero, the project will not provide enough financial benefits to justify the investment, since there are alternative investments that will earn at least the rate of return of the investment.

In theory, a company will select all the projects with a positive NPV. However, because of capital or budget constraints, companies usually employ a concept called NPV Indexes to prioritize projects having the highest value. The NPV Indexes are calculated by dividing each project's NPV by its initial cash outlay. The higher the NPV Index, the greater the investment opportunity.

The NPV analysis is highly flexible and can be combined with other financial evaluation tools such as Decision Tree models, and Scenario and Monte Carlo analyses. Decision Trees are used to establish the expected cash flows of multiple cash flows each one having a distinct probability of occurring.

The expected cash flows are then calculated from all the possible cash flows and their associated probabilities. NPV and Scenario Analysis are combined by varying a predetermined set of assumptions to determine the overall impact on the NPV value of the project. Finally, Monte Carlo analysis provides a deeper understanding of the relationship between the assumptions and the final NPV value. The Monte Carlo analysis calculates the standard deviation or ultimate change of NPV by using a set of different assumptions that dominate the end result."

6.4 Internal Rate of Return (IRR))

From: http://en.wikipedia.org/wiki/Internal_rate_of_return:

The internal rate of return (IRR) is a capital budgeting method used by firms to decide whether they should make long-term investments. The IRR is the return rate which can be earned on the invested capital, i.e. the yield on the investment.

A project is a good investment proposition if its IRR is greater than the rate of interest that could be earned by alternative investments (investing in other projects, buying bonds, even putting the money in a bank account). The IRR should include an appropriate risk premium. Mathematically the IRR is defined as any discount rate that results in a net present value of zero of a series of cash flows.

In general, if the IRR is greater than the project's cost of capital, or hurdle (i.e., discount) rate, the project will add value for the company.

From http://www.odellion.com:

The Internal Rate of Return (IRR) is defined as the discount rate that makes the project have a zero Net Present Value (NPV). IRR is an alternative method of evaluating investments without estimating the discount rate. IRR takes into account the time value of money by considering the cash flows over the lifetime of a project. The IRR and NPV concepts are related but they are not equivalent.

The IRR uses the NPV equation as its starting point:

$$NPV = 0 = \text{inital investment} + \frac{\text{Cash flow Year 1}}{(1+IRR)^1} + \ldots + \frac{\text{Cash flow Year n}}{(1+IRR)^n}$$

Definition of Terms

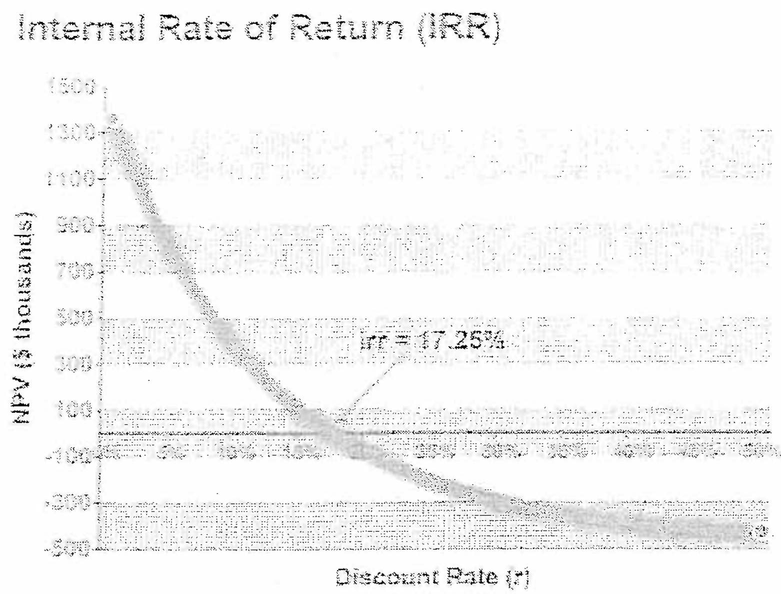
Initial investment: The investment at the beginning of the project.

Cash Flow: Measure of the actual cash generated by a company or the amount of cash earned after paying all expenses and taxes.

IRR: Internal Rate of Return.

n: Last year of the lifetime of the project.

Calculating the IRR is done through a trial-and-error process that looks for the Discount Rate that yields an NPV equal to zero. The trial-and-error calculation can by accomplished by using the IRR function in a spreadsheet program or with a programmable calculator. The graph below was plotted for a wide range of rates until the IRR was found that yields an NPV equal to zero (at the intercept with the x-axis).



As in the example above, a project that has a discount rate less than the IRR will yield a positive NPV. The higher the discount rate the more the cash flows will be reduced, resulting in a lower NPV of the project. The company will approve any project or investment where the IRR is higher than the cost of capital as the NPV will be greater than zero.

For example, the IRR for a particular project is 20%, and the cost of capital to the company is only 12%. The company can approve the project because the maximum value for the company to make money would be 8% more than the cost of capital. If the company had a cost of capital for this particular project of 21%, then there would be a negative NPV and the project would not be considered a profitable one.

The IRR is therefore the maximum allowable discount rate that would yield value considering the cost of capital and risk of the project. For this reason, the IRR is sometimes referred to as a break-even rate of return. It is the rate at which the value of cash outflow equals the value of cash inflow.

There are some special situations where the IRR concept can be misinterpreted. This is usually the case when periods of negative cash flow affect the value of IRR without accurately reflecting the underlying performance of the investment. Managers may misinterpret the IRR as the annual equivalent return on a given investment. This is not the case, as the IRR is the breakeven rate and does not provide an absolute view on the project return.

SECTION 7. ECONOMIC FEASIBILITY OF CORDWOOD SYSTEMS

7.1 Initial Investment Cost Estimates

Short of having an actual Design & Engineering Report or a Concept Design Report prepared by a licensed professional engineer, there is no way to determine actual costs for any particular system at any particular site. Such a report is beyond the scope of this assessment. However, three generic system scenarios are offered as a means of comparison. Actual costs, assumptions and "guess-timates" are identified as such, where appropriate.

Wood heating systems include the cost of the fuel delivery and storage facilities, boiler equipment, boiler building (if necessary), plumbing and connections, heat exchangers, electrical service to integrate with existing distribution systems, installation and, for larger and institutional projects, an allowance for engineering and contingency.

Before a true economic analysis can be performed, all of the costs (investment and O&M) must be identified, and this is where the services of a mechanical and, perhaps, a civil engineer are necessary.

Table 7-1 presents generic scenarios of initial investment costs for three cordwood systems (small, medium and large). The total system cost is often two to three times the cost of the boiler itself; more if buildings must be constructed.

Table 7-1. Initial Investment Cost Scenarios for Generic Cordwood Systems

Facility	Small	Medium	Large
Fuel oil consumption, gallons per year	5,000	15,000	25,000
Calculated required boiler capacity (RBC)	200,000	650,000	1,000,000
Cordwood boiler Btu/hr	Garn WHS 1500 350,000	Garn WHS 3200 950,000	Garn WHS 3200 950,000
Building and Equipment (B&E) Costs			
too low *Fuel storage pole barn*[a] *$15 per sf*	*$14,100* *(47 cords; 940 sf)*	*$42,000* *(140 cords; 2,800 sf)*	*$70,500* *(235 cords; 4,700 sf)*
Boiler Building *$35 per sf*	*$8,960* *(16 x 16)*	*$14,000* *(20 x 20)*	*$14,000* *(20 x 20)*
Boilers *Base price*[c] *Shipping*[b]	*$11,540* *$1,500*	*$27,700* *$2,500*	*$27,700* *$2,500*
Plumbing/connections[b]	*$2,500*	*$4,000*	*$5,000*
Installation[b]	*$2,000*	*$3,000*	*$3,000*
Total Direct (B&E) Costs	$40,600	$93,200	$122,700
Engineering + Contingency (10%)[b]	$4,060	$9,320	$12,270
Grand Total	$44,660	$102,520	$134,970

Notes:
[a] A cord occupies 128 cubic feet. If the wood is stacked 6½ feet high, the area required to store the wood is 21 square feet per cord.
[b] unsubstantiated "guess-timate"
[c] List price, Dectra Corp, May 2006

Building(s) and plumbing/connections are the most significant costs besides the boiler. Building costs deserve more site-specific investigation, and often need to be minimized to the extent possible. Piping from the wood-fired boiler is another area of potential cost saving. Long piping runs and additional heat exchangers substantially increase project costs. The hard copper pipe normally used in Alaska costs $70 to 100/foot, installed. If plastic or PEX piping is used the cost can be reduced to about $40/foot.

Allowance for indirect non-capital costs such as engineering and contingency are most important for large systems that involve extensive permitting and budget approval by public agencies. This can increase the cost of a project by 25% to 50%.

7.2 Generic OM&R Cost Estimates

The primary operating cost, other than the cost of fuel, is labor. Labor is required to move fuel from the storage area to the boiler building, stoke the boiler, clean the boiler and dispose of ash. For purposes of this analysis, it is assumed that the boiler will operate every day for 210 days (30 weeks) per year between mid-September and mid-April.

For this assessment, it is assumed that the average daily labor requirement is ¾ hour for a small boiler application, 1.15 hours for a medium size installation, and 1.5 hours for a large installation. An additional ¾, 1.15 and 1.5 hours per week (for small, medium and large installations respectively) are allocated to move fuel and perform routine maintenance tasks.

NOTE: The actual daily labor requirement is a function of the number of times the boiler requires stoking to meet the heating demand. This should be able to be calculated to some degree of certainty based on average daily energy demand and the amount of energy that can be derived per stoking. Assuming it takes 12 to 15 minutes to stoke the boiler, then 1 hour per day would allow for 4 to5 stokings per day, which is assumed to be sufficient for this exercise.

Given the foregoing assumptions, the total annual labor requirements are presented in Table 7-2.

Table 7-2. Labor/Cost Estimates for Generic Cordwood Systems

Facility	Small	Medium	Large
Daily (hrs) (210 da/yr x X hr/da)	210 x .75 = 157.5	210 x 1.15 = 241.5	210 x 1.5 = 315
Weekly (hrs) (30 wk/yr x X hr/wk)	30 x .75 = 22.5	30 x 1.15 = 34.5	30 x 1.5 = 45
Total (hrs) (Daily + weekly)	180	276	360
Total annual cost ($) (Hrs x $20/hr)	3,600	5,520	7,200

There is also an electrical cost component to the boiler operation. An electric fan creates the induced draft that contributes to boiler efficiency. One estimate predicted that, at $0.30 per kWh, the cost of operating the fan would be approximately **$100 - $200** per year. The cost of operating circulation pumps would be the same as it would be with the oil-fired boiler.

Lastly there is the cost of firebrick replacement. This has been suggested at **$300 - $500** per year. Partially offsetting the OM&R costs for the wood-fueled system are the OM&R costs of the oil-fired system. While oil-fired systems require little in the way of labor, they do generally require annual some annual maintenance. A savings of **$500 - $700** per year is being allowed for this item.

Table 7-3. Summary of Total Annual OM&R Cost Estimates			
Item	Cost/Allowance		
	Small	Medium	Large
Labor	3,600	5,520	7,200
Electricity	100	150	200
Maintenance	300	400	500
Oil boiler maintenance offset	-500	-600	-700
Total, net non-fuel O&M	3,500	5,470	7,200

7.3 Calculation of Financial Metrics

A discussion of Simple Payback Period can be found in Section 6.1.
A discussion of Present Value can be found in Section 6.2.
A discussion of Net Present Value can be found in section 6.3.
A discussion of Internal Rate of Return can be found in section 6.4.

7.3.1 Simple Payback Period for Small, Medium and Large Cordwood Boilers

Table 7-4 presents a Simple Payback Period analysis for a generic small, medium and large HELE cordwood boiler.

Table 7-4. Simple Payback Period Analysis			
Facility	Small (5,000 gpy; 47 cds/yr)	Medium (15,000 gpy; 140 cds/yr)	Large (25,000 gpy; 235 cds/yr)
Fuel oil, $ per year @ $3.00 per gallon	15,000	45,000	75,000
Cordwood, $ per year @ $125 per cord	5,875	17,500	29,375
Gross annual savings ($)	9,125	27,500	45,625
Total Investment Costs ($)	*44,660*	*102,520*	*134,970*
Simple Payback (years)	4.89	3.73	2.96

7.3.2 PV, NPV and IRR Estimates for a Small Generic Cordwood Boiler

Table 7-5 calculates Present Value (PV), Net Present Value (NPV) and Internal Rate of Return (IRR) using a Discount Rate of 5%. Costs and operating expenses for a small HELE cordwood boiler were generated earlier in this report.

N.G.

(NO GOOD)

Table 7-5. PV, NPV and IRR Estimates For a Small Generic Cordwood Boiler Installation									
Years (T)	($) Initial Investment	Non-fuel + OM&R ($)	Fuel Oil ($)	Wood Fuel ($)	Savings ($)	Discount Rate (%)	PV ($)	NPV ($)	IRR (%)
0	-44,660	0	0	0	0	5	0	-44,660	
1		3,500	15,000	5,875	5,625	5	5,357	-39,303	-88.01
2		3,500	15,000	5,875	5,625	5	5,102	-34,201	-59.68
3		3,500	15,000	5,875	5,625	5	4,859	-29,342	-39.46
4		3,500	15,000	5,875	5,625	5	4,628	-24,714	-26.40
5		3,500	15,000	5,875	5,625	5	4,407	-20,307	-17.78
6		3,500	15,000	5,875	5,625	5	4,197	-16,109	-11.87
7		3,500	15,000	5,875	5,625	5	3,998	-12,112	-7.67
8		3,500	15,000	5,875	5,625	5	3,807	-8,304	-4.60
9		3,500	15,000	5,875	5,625	5	3,626	-4,679	-2.30
10		3,500	15,000	5,875	5,625	5	3,453	-1,225	-0.54
						10 year PV = 43,435			
11		3,500	15,000	5,875	5,625	5	3,289	2,064	0.83
12		3,500	15,000	5,875	5,625	5	3,132	5,196	1.91
13		3,500	15,000	5,875	5,625	5	2,983	8,179	2.78
14		3,500	15,000	5,875	5,625	5	2,841	11,020	3.48
15		3,500	15,000	5,875	5,625	5	2,706	13,726	4.06
16		3,500	15,000	5,875	5,625	5	2,577	16,302	4.53
17		3,500	15,000	5,875	5,625	5	2,454	18,757	4.92
18		3,500	15,000	5,875	5,625	5	2,337	21,094	5.25
19		3,500	15,000	5,875	5,625	5	2,226	23,320	5.53
20		3,500	15,000	5,875	5,625	5	2,120	25,440	5.76
						20 year PV = 70,100			

Using the online NPV calculator found at: http://www.investopedia.com/calculator/NetPresentValue.aspx and given the following inputs (from Table 7-5):

Discount Rate: 5%
Life of Project: 10 years
Initial Cost: $44,660 (expressed as a negative value)
Annual cash flow ("savings" each year for 10 years): $5,625

The results were:

Net Present Value (at 10 years): -$1,225.24
Present Value of Expected Cash Flows: $43,434.76

With a discount rate of 5.00% and a span of 10 years, the projected cash flows are worth $43,434.76 today (PV), which is less than the initial investment of $44,660.00. The resulting NPV of the project is -$1,225.24, which means that the project sponsor will not receive the required return [i.e., 5%] at the end of 10 years. Pursuing the project may not be an optimal decision.

However, even though the proposed project returned a negative NPV, it may still be worth pursuing. The value of *real options** in a capital budgeting decision could increase the NPV of a project. For example, research and development projects are risky because the product created is not guaranteed to be successful. However, if it is successful, the potential payoff could be substantial. Alternately, NPV could be negative also because the required rate of return is unrealistically high or the cash flows projected may be too conservative.

** Note that this kind of option is not a derivative instrument, but an actual option (in the sense of "choice") that a business may gain by undertaking certain endeavors. For example, by investing in a particular project, a company may have the real option of expanding, downsizing, or abandoning other projects in the future. Other examples of real options may be opportunities for R&D, M&A, and licensing.*

They are referred to as "real" because they usually pertain to tangible assets, such as capital equipment, rather than financial instruments. Taking into account real options can greatly effect the valuation of potential investments. Oftentimes, however, valuation methods, such as NPV, do not include the benefits that real options provide.

Source: http://www.investopedia.com/terms/r/realoption.asp

NOTE: With the discount rate at 4.43%, NPV is positive in 10 years, and at 5.00%, NPV becomes positive in year 11.

7.3.3 PV, NPV and IRR Estimates for a Medium Generic Cordwood Boiler

Table 7-6 calculates Present Value (PV), Net Present Values (NPV) and Internal Rate of Return (IRR) using a Discount Rate of 5%. Costs and operating expenses for a medium HELE cordwood boiler were generated earlier in this report.

Table 7-6. PV, NPV and IRR Estimates For a Medium Generic Cordwood Boiler Installation

Years (T)	($) Initial Investment	Non-fuel + OM&R ($)	Fuel Oil ($)	Wood Fuel ($)	Savings ($)	Discount Rate (%)	PV ($)	NPV ($)	IRR (%)
0	-102,520	0	0	0	0	5	-102,520		
1		5,470	45,000	17,500	22,030	5	20,981	-81,539	-79.53
2		5,470	45,000	17,500	22,030	5	19,982	-61,557	-44.45
3		5,470	45,000	17,500	22,030	5	19,030	-42,527	-22.96
4		5,470	45,000	17,500	22,030	5	18,124	-24,403	-10.28
5		5,470	45,000	17,500	22,030	5	17,261	-7,142	-2.44
6		5,470	45,000	17,500	22,030	5	16,439	9,297	2.65
7		5,470	45,000	17,500	22,030	5	15,656	24,954	6.08
8		5,470	45,000	17,500	22,030	5	14,911	39,865	8.48
9		5,470	45,000	17,500	22,030	5	14,201	54,065	10.20
10		5,470	45,000	17,500	22,030	5	13,525	67,590	11.46
						10 year PV = 170,110			
11		5,470	45,000	17,500	22,030	5	12,880	80,470	12.39
12		5,470	45,000	17,500	22,030	5	12,267	92,737	13.10
13		5,470	45,000	17,500	22,030	5	11,683	104,420	13.65
14		5,470	45,000	17,500	22,030	5	11,127	115,547	14.07
15		5,470	45,000	17,500	22,030	5	10,597	126,144	14.39
16		5,470	45,000	17,500	22,030	5	10,092	136,236	14.65
17		5,470	45,000	17,500	22,030	5	9,612	145,848	14.86
18		5,470	45,000	17,500	22,030	5	9,154	155,002	15.02
19		5,470	45,000	17,500	22,030	5	8,718	163,720	15.15
20		5,470	45,000	17,500	22,030	5	8,303	172,022	15.25
						20 year PV = 274,542			

Using the online NPV calculator found at: http://www.investopedia.com/calculator/NetPresentValue.aspx and given the following inputs:

Discount Rate: 5%
Life of Project: 10 years
Initial Cost: $102,520
Annual cash flow for 10 years: $22,030

NG

The results were:

Net Present Value (at 10 years):	$ 67,589.82
Present Value of Expected Cash Flows:	$170,109.82

With a discount rate of 5.00% and a span of 10 years, the projected cash flows are worth $170,109.82 today, which is greater than the initial investment of $102,520.00. The resulting positive NPV of the project is $67,589.82, which indicates that pursuing the project may be optimal.

Remember that even though a project offers a positive NPV, the projected cash flows are still estimates. The accuracy of these projected figures depends on the skill and experience of the analyst, and likelihood of these cash flows materializing depends on the financial risk associated with the type of project being pursued.

7.3.4 PV, NPV and IRR Estimates for a Large Generic Cordwood Boiler Installation

Table 7-7 calculates Present Value (PV), Net Present Values (NPV) and Internal Rate of Return (IRR) using a Discount Rate of 5%. Costs and operating expenses for a large HELE cordwood boiler were generated earlier in this report.

NG

Table 7-7. PV, NPV and IRR Estimates For a Large Generic Cordwood Boiler Installation									
Years (T)	($) Initial Investment	Non-fuel + OM&R ($)	Fuel Oil ($)	Wood Fuel ($)	Savings ($)	Discount Rate (%)	PV ($)	NPV ($)	IRR (%)
0	-134,970	0	0	0	0	5	-134,970		
1		7,200	75,000	29,375	38,425	5	36,595	-98,375	-72.89
2		7,200	75,000	29,375	38,425	5	34,853	-63,522	-33.85
3		7,200	75,000	29,375	38,425	5	33,193	-30,329	-11.90
4		7,200	75,000	29,375	38,425	5	31,612	1,283	0.39
5		7,200	75,000	29,375	38,425	5	30,107	31,390	7.67
6		7,200	75,000	29,375	38,425	5	28,673	60,063	12.22
7		7,200	75,000	29,375	38,425	5	27,308	87,371	15.19
8		7,200	75,000	29,375	38,425	5	26,008	113,379	17.19
9		7,200	75,000	29,375	38,425	5	24,769	138,148	18.58
10		7,200	75,000	29,375	38,425	5	23,590	161,738	19.56
						10 year PV = 296,708			
11		7,200	75,000	29,375	38,425	5	22,466	184,204	20.27
12		7,200	75,000	29,375	38,425	5	21,396	205,600	20.79
13		7,200	75,000	29,375	38,425	5	20,378	225,978	21.17
14		7,200	75,000	29,375	38,425	5	19,407	245,385	21.45
15		7,200	75,000	29,375	38,425	5	18,483	263,868	21.66
16		7,200	75,000	29,375	38,425	5	17,603	281,471	21.82
17		7,200	75,000	29,375	38,425	5	16,765	298,236	21.95
18		7,200	75,000	29,375	38,425	5	15,966	314,202	22.04
19		7,200	75,000	29,375	38,425	5	15,206	329,408	22.11
20		7,200	75,000	29,375	38,425	5	14,482	343,890	22.17
						20 year PV = 478,860			

Using the online NPV calculator found at: http://www.investopedia.com/calculator/NetPresentValue.aspx and given the following inputs:

Discount Rate: 5%
Life of Project: 10 years
Initial Cost: $134,970
Annual cash flow for 10 years: $38,425
The results were:

Net Present Value (at 10 years): $161,737.66
Present Value of Expected Cash Flows: $296,707.66

With a discount rate of 5.00% and a span of 10 years, the projected cash flows are worth $296,707.66 today, which is greater than the initial investment of $134,970.00. The resulting positive NPV of the above project is $161,737.66, which indicates that pursuing the project may be optimal

Remember that even though a project has a positive NPV, the projected cash flows are still estimations. The accuracy of these projected figures depends on the skill and experience of the analyst, and likelihood of these cash flows materializing depends on the financial risk associated with the type of project being pursued.

7.4 The Effect of Discount Rate on Financial Metrics of Cordwood Boilers

Table 7-8 looks at present value (PV), net present value (NPV) and internal rate of return (IRR) of generic small, medium and large cordwood boiler systems as a function of the discount rate, from 1% to 10%, given a project life span of 10 years.

Table 7-8. PV, NPV and IRR as a Function of Discount Rate									
Facility:	Small (5,000 gpy; 47 cds/yr)			Medium (15,000 gpy; 140 cds/yr)			Large (25,000 gpy; 235 cds/yr)		
Initial Investment	44,660			102,520			134,970		
Annual Savings	5,625			22,030			38,425		
Life Span	10			10			10		
Discount Rate:	PV ($)	NPV ($)	IRR (%)	PV ($)	NPV ($)	IRR (%)	PV ($)	NPV ($)	IRR (%)
1 %	53,276	8,616	3.40	208,653	106,133	15.87	363,935	228,965	24.30
2 %	50,527	5,867	2.38	197,886	95,366	14.73	345,156	210,186	23.08
3 %	47,982	3,322	1.39	187,920	85,400	13.62	327,773	192,803	21.89
4 %	45,624	964	0.41	178,683	76,163	12.53	311,661	176,691	20.71
5 %	43,435	-1,225	-0.54	170,110	67,590	11.46	296,708	161,738	19.56
6 %	41,400	-3,260	-1.48	162,143	59,623	10.40	282,811	147,841	18.44
7 %	39,508	-5,152	-2.40	154,730	52,210	9.37	269,881	134,911	17.33
8 %	37,774	-6,916	-3.30	147,823	45,303	8.36	257,835	122,865	16.24
9 %	36,099	-8,561	-4.19	141,381	38,861	7.37	246,598	111,628	15.18
10 %	34,563	-10,097	-5.06	135,365	32,845	3.39	236,105	101,135	14.13

As this and other tables indicate, there is a strong relationship between project feasibility and size of the project (related to net annual savings). Feasibility improves as system size and savings increase.

SECTION 8. ECONOMIC FEASIBILITY OF BULK FUEL SYSTEMS

A typical bulk fuel boiler system includes wood fuel storage, a boiler building, wood fuel handling systems, combustion chamber, boiler, ash removal, cyclone, stack and electronic controls. The variables in this list of system components include the use of silos of various sizes for wood fuel storage, chip storage areas of various sizes, boiler buildings of various sizes, automated versus manual ash removal and cyclones for particulate removal.[17]

As shown in Table 5-4, the Northway School consumes an estimated 25,000 gpy of fuel oil and is estimated to use 535 tons of bulk fuel. At this level of consumption, this facility is probably "borderline" in terms of economic feasibility regarding a bulk fuel system. On the other hand, the Tok School and Multi-Purpose Facility at 45,000 to 50,000 gpy (bulk fuel estimate = 1,028 tons) is a likely candidate for a bulk fuel system.

8.1 Capital Cost Components

As indicated, bulk fuel systems are larger, more complex and more costly to install and integrate with existing boiler and distribution systems. Before a true economic analysis can be performed, *all* of the costs (capital, non-capital and OM&R) must be identified, and this is where the services of civil and mechanical engineers are necessary.

Table 8-1 outlines the various general components for two generic bulk fuel systems (small and medium), however it is beyond the scope of this report to offer estimates of costs for those components. As an alternative, two generic sizes, small and medium, are presented for comparison purposes.

Table 8-1. Initial Investment Costs for Generic Bulk Fuel Systems

Facility	Small (25,000 gpy)	Medium (50,000 gpy)
Capital Costs: Building and Equipment (B&E)		
Fuel storage building		
Material handling system	?	?
Boiler building		
Boiler: base price shipping		
Plumbing/connections		
Electrical systems		
Installation		
Total Capital (B&E) Costs[a]		
Non-capital Costs		
Engineering, Contingency, Permitting, etc.		
Initial Investment Total ($)	400,000 to 650,000	750,000 to 1,250,000

Building(s) and plumbing/connections are the most significant costs besides the boiler. Building costs deserve more site-specific investigation. Piping from the wood-fired boiler is another area of potential cost saving. Long piping runs and additional heat exchangers substantially increase project costs.

Allowance for indirect costs such as engineering and contingency are most important for larger systems that involve extensive permitting and budget approval by public agencies. This can increase the cost of a project by 25% to 50%.

8.2 Generic OM&R Cost Allowances

The primary operating cost is fuel. The estimated bulk fuel cost for the Northway School is **$21,400** (535 tons @ $40/ton). The estimated bulk fuel cost for Tok School/MPF is **$41,120** (1,028 tons @ $40/ton).

Other O&M costs would include labor, electricity and maintenance/repairs. For purposes of this analysis, it is assumed that the boiler will operate every day for 210 days (30 weeks) per year between mid-September and mid-April.

Daily labor would consist of monitoring the system and performing daily inspections as prescribed by the system manufacturer. It is assumed that the average daily labor requirement is ½ hour. An additional 1 hour per week is allocated to perform routine maintenance tasks. Therefore, the total annual labor requirement is (210 x 0.5) + 30 = 135 hours per year. At $20 per hour (loaded), the annual labor cost would be **$2,700**.

There is also an electrical cost component to the boiler operation. Typically, electrically-powered conveyors of various sorts are used to move fuel from its place of storage to a metering bin and into the boiler. There are also numerous other electrical systems that operate various pumps, fans, etc. The Darby High School system, which burned 755 tons of bulk fuel in 2005, used electricity in the amount of $2,035,[18] however the actual kWh or cost per kWh were not reported. Another report[17] proffered an average electricity cost for Montana of $0.086 per kWh. If that rate is true for Darby, then the electrical consumption would have been about 23,663 kWh.

The Northway School is projected to use 535 tons of bulk fuel (71% of the amount used at Darby). If it is valid to apportion the electrical usage based on bulk fuel consumption, then Northway would use about 16,800 kWh per year. At $0.30 per kWh, the annual electrical consumption would be **$5,040**. Using the same logic, the Tok School/MPF (136% of the amount used at Darby) would use **$9,665** worth of electricity to operate the system.

Lastly, there is the cost of maintenance and repair. Bulk fuel systems with their conveyors, fans, bearings, motors, etc. have more wear parts. An arbitrary allowance of **$2,000** is made to cover these costs.

Total annual operating, maintenance and repair cost estimates are summarized in Table 8-2

Table 8-2. Total OM&R Cost Allowances for Bulk Fuel Systems		
Item	Cost/Allowance	
	Small	Medium
Non-Fuel OM&R		
Labor ($)	2,700	2,700
Electricity ($)	5,040	9,665
Maintenance ($)	2,000	2,000
Total, non-fuel OM&R	$ 9,740	$ 14,365
Wood fuel ($)	21,400	41,120
Total OM&R ($)	$ 31,140	$ 55,485

8.3 Calculation of Financial Metrics

A discussion of Simple Payback Period can be found in Section 6.1.
A discussion of Present Value can be found in Section 6.2.
A discussion of Net Present Value can be found in section 6.3.
A discussion of Internal Rate of Return can be found in section 6.4.

8.3.1 Simple Payback Period for Small and Medium Bulk Fuel Boilers

Table 8.3 presents a Simple Payback Period analysis for a range of initial investment cost estimates for generic small and medium bulk fuel boiler systems.

Table 8-3. Simple Payback Period Analysis						
Facility	Small (25,000 gpy; 535 tons/yr)			Medium (50,000 gpy; 1,028 tons/yr)		
Fuel oil, $ per year @ $3.00 per gallon	75,000			150,000		
Bulk Fuel, $ per year @ $40 per ton	21,400			41,120		
Fuel cost savings ($)	53,600			108,880		
Total Investment Costs ($)	400,000	525,000	650,000	750,000	1,000,000	1,250,000
Simple Payback (years)	7.46	9.79	11.19	6.89	9.18	11.48

8.3.2 PV, NPV and IRR Estimates for a Small Generic Bulk Fuel Boiler

Table 8-4 calculates Present Value (PV), Net Present Values (NPV) and Internal Rate of Return (IRR) using a Discount Rate of 5%. The medium initial investment cost from Table 8-3 and operating expenses from Table 8-2 were applied in Table 8-4.

Table 8-4. PV, NPV and IRR Estimates For a Small Generic Bulk Fuel Boiler Installation

Years (T)	($) Initial Investment	Non-fuel O&M&R ($)	Fuel Oil ($)	Wood Fuel ($)	Savings ($)	Discount Rate (%)	PV ($)	NPV ($)	IRR (%)
0	-525,000								
1		9,740	75,000	21,400	43,860	5	41,771	-483,229	-92.04%
2		9,740	75,000	21,400	43,860	5	39,782	-443,446	-68.21%
3		9,740	75,000	21,400	43,860	5	37,888	-405,558	-49.18%
4		9,740	75,000	21,400	43,860	5	36,084	-369,475	-36.12%
5		9,740	75,000	21,400	43,860	5	34,365	-335,109	-27.11%
6		9,740	75,000	21,400	43,860	5	32,729	-302,380	-20.72%
7		9,740	75,000	21,400	43,860	5	31,170	-271,210	-16.05%
8		9,740	75,000	21,400	43,860	5	29,686	-241,523	-12.55%
9		9,740	75,000	21,400	43,860	5	28,273	-213,251	-9.86%
10		9,740	75,000	21,400	43,860	5	26,926	-186,325	-7.75%
						10 year PV = 338,675			
11		9,740	75,000	21,400	43,860	5	25,644	-160,681	-6.08%
12		9,740	75,000	21,400	43,860	5	24,423	-136,258	-4.73%
13		9,740	75,000	21,400	43,860	5	23,260	-112,998	-3.62%
14		9,740	75,000	21,400	43,860	5	22,152	-90,846	-2.70%
15		9,740	75,000	21,400	43,860	5	21,097	-69,748	-1.94%
16		9,740	75,000	21,400	43,860	5	20,093	-49,655	-1.30%
17		9,740	75,000	21,400	43,860	5	19,136	-30,519	-0.75%
18		9,740	75,000	21,400	43,860	5	18,225	-12,295	-0.29%
19		9,740	75,000	21,400	43,860	5	17,[illegible]	5,062	0.11%
20		9,740	75,000	21,400	43,860	5	16,530	**21,593**	0.46%
						20 year PV = 546,593			
21		9,740	75,000	21,400	43,860	5	15,743	37,336	0.76%
22		9,740	75,000	21,400	43,860	5	14,994	52,329	1.02%
23		9,740	75,000	21,400	43,860	5	14,280	66,609	1.25%
24		9,740	75,000	21,400	43,860	5	13,600	80,208	1.45%
25		9,740	75,000	21,400	43,860	5	12,952	93,160	1.62%
26		9,740	75,000	21,400	43,860	5	12,335	105,496	1.78%
27		9,740	75,000	21,400	43,860	5	11,748	117,243	1.92%
28		9,740	75,000	21,400	43,860	5	11,188	128,432	1.92%
29		9,740	75,000	21,400	43,860	5	10,656	139,087	2.15%
30		9,740	75,000	21,400	43,860	5	10,148	149,236	2.25%
						30 year PV = 674,236			

Using the online NPV calculator found at: http://www.investopedia.com/calculator/NetPresentValue.aspx and given the following inputs:

Discount Rate: 5%
Life of Project: 10 years
Initial Cost: $525,000 (expressed as negative value)
Annual cash flow ("savings" each year for 10 years): $43,860

The results were:

Net Present Value:	-$186,324.71
PV of Expected Cash Flows:	$338,675.29

With a discount rate of 5.00% and a span of 10 years, the projected cash flows are worth $338,675.29 today (PV), which is less than the initial investment of $525,000.00. The resulting NPV of the project is -$186,324.71, which means that the project sponsor will not receive the required return [i.e., 5%] at the end of 10 years. Pursuing the above project may not be an optimal decision.

However, even though the projected capital project returned a negative NPV, it may still be worth pursuing. The valuation of *real options** in a capital budgeting decision could increase the NPV of a project. For example, research and development projects are risky because the product created is not guaranteed to be successful; however, if it is successful, the potential payoff could be substantial. Alternately, NPV could be negative also because the required rate of return may be unrealistically high, or the cash flows projected may be too conservative.

** Note that this kind of option is not a derivative instrument, but an actual option (in the sense of "choice") that a business may gain by undertaking certain endeavors. For example, by investing in a particular project, a company may have the real option of expanding, downsizing, or abandoning other projects in the future. Other examples of real options may be opportunities for R&D, M&A, and licensing.*

They are referred to as "real" because they usually pertain to tangible assets, such as capital equipment, rather than financial instruments. Taking into account real options can greatly effect the valuation of potential investments. Oftentimes, however, valuation methods, such as NPV, do not include the benefits that real options provide.

Source: http://www.investopedia.com/terms/r/realoption.asp

8.3.3 PV, NPV and IRR Estimates for a Medium Generic Bulk Fuel Boiler

Table 8-4 calculates Present Value (PV), Net Present Values (NPV) and Internal Rate of Return (IRR) using a Discount Rate of 5%. The medium initial investment cost from Table 8-3 and operating expenses from Table 8-2 were applied in Table 8-4.

Table 8-5. PV, NPV and IRR Estimates For a Medium Generic Bulk Fuel Boiler Installation									
Years (T)	($) Initial Investment	Non-fuel + OM&R ($)	Fuel Oil ($)	Wood Fuel ($)	Savings ($)	Discount Rate (%)	PV ($)	NPV ($)	IRR (%)
0	-1,000,000					5			
1		14,365	150,000	41,120	94,515	5	90,014	-909,986	-91.00%
2		14,365	150,000	41,120	94,515	5	85,728	-824,258	-65.88%
3		14,365	150,000	41,120	94,515	5	81,646	-742,612	-46.48%
4		14,365	150,[illegible]	41,120	94,515	5	77,758	-664,854	-33.40%
5		14,365	150,000	41,120	94,515	5	74,055	-590,800	-24.49%
6		14,365	1[illegible]	41,120	94,515	5	70,529	-520,271	-18.23%
7		14,365	150,000	41,120	94,515	5	67,170	-453,101	-13.69%
8		1[illegible]	150,000	41,120	94,515	5	63,971	-389,129	-10.31%
9		14,365	150,000	41,120	94,515	5	60,925	-328,204	-7.73%
10		14,36[illegible]	150,000	41,120	94,515	5	58,024	-270,180	-5.73%
						10 year PV = 729,820			
11		14,365	150,000	41,120	94,515	5	55,261	-214,919	-4.14%
12		14,365	150,000	41,120	94,515	5	52,629	-162,290	-2.86%
13		14,365	150,000	41,120	94,515	5	50,123	-112,166	-1.83%
14		14,365	150,000	41,120	94,515	5	47,736	-64,430	-0.98%
15		14,365	150,000	41,120	94,515	5	45,463	-18,967	-0.27%
16		14,365	150,000	41,120	94,515	5	43,298	24,332	0.32%
17		14,365	150,000	41,120	94,515	5	41,237	65,568	0.82%
18		14,365	150,000	41,120	94,515	5	39,273	104,841	1.25%
19		14,365	150,000	41,120	94,515	5	37,403	142,244	1.61%
20		14,365	150,000	41,120	94,515	5	35,622	177,866	1.92%
						20 year PV = 1,177,866			
21		14,365	150,000	41,120	94,515	5	33,925	211,791	2.19%
22		14,365	150,000	41,120	94,515	5	32,310	244,101	2.42%
23		14,365	150,000	41,120	94,515	5	30,771	274,873	2.62%
24		14,365	150,000	41,120	94,515	5	29,306	304,179	2.80%
25		14,365	150,000	41,120	94,515	5	27,91[illegible]	332,089	2.96%
26		14,365	150,000	41,120	94,515	5	26,581	358,67[illegible]	3.09%
27		14,365	150,000	41,120	94,515	5	25,316	383,[illegible]86	3.21%
28		14,365	150,000	41,120	94,515	5	2[illegible]110	40[illegible],09[illegible]	3.21%
29		14,365	150,000	41,120	94,515	5	22,[illegible]62	431,[illegible]59	3.41%
30		14,365	150,000	41,120	94,515	5	21,[illegible]	452,927	3.50%
						30 year PV = 1,[illegible]52[illegible]27			

Using the online NPV calculator found at: http://www.investopedia.com/calculator/NetPresentValue.aspx and given the following inputs (from Table 7-5):

Discount Rate: 5%
Life of Project: 10 years
Initial Cost: $1,000,000 (expressed as a negative value)
Annual cash flow ("savings" each year for 10 years): $94,515

The results were:

Net Present Value:	-$270,180.22
PV of Expected Cash flows:	$729,819.78

With a discount rate of 5.00% and a span of 10 years, the projected cash flows are worth $729,819.78 today (PV), which is less than the initial investment of $1,000,000.00. The resulting NPV of the project is -$270,180.22 which means the project sponsor will not receive the required return [i.e., 5%] at the end of 10 years. Pursuing the above project may not be an optimal decision.

However, even though the projected capital project returned a negative NPV, it may still be worth pursuing. The valuation of *real options** in a capital budgeting decision could increase the NPV of a project. For example, research and development projects are risky because the product created is not guaranteed to be successful; however, if it is successful, the potential payoff could be substantial. Alternately, NPV could be negative also because the required rate of return may be unrealistically high, or the cash flows projected may be too conservative.

** Note that this kind of option is not a derivative instrument, but an actual option (in the sense of "choice") that a business may gain by undertaking certain endeavors. For example, by investing in a particular project, a company may have the real option of expanding, downsizing, or abandoning other projects in the future. Other examples of real options may be opportunities for R&D, M&A, and licensing.*

They are referred to as "real" because they usually pertain to tangible assets, such as capital equipment, rather than financial instruments. Taking into account real options can greatly effect the valuation of potential investments. Oftentimes, however, valuation methods, such as NPV, do not include the benefits that real options provide.

Source: http://www.investopedia.com/terms/r/realoption.asp

8.4 The Effect of Discount Rate on Financial Metrics of Bulk Fuel Boilers

Table 8-6 looks at present value (PV), net present value (NPV) and internal rate of return (IRR) as a function of discount rate (from 1% to 10%) at 20 years for a range of small bulk fuel boiler system investment costs.

Table 8-6. PV, NPV and IRR as a Function of Discount Rate for a Range of Small Bulk Fuel System Investment Costs

Initial Investment	400,000			525,000			650,000		
Annual Savings	43,860			43,860			43,860		
Life Span	20			20			20		
Discount Rate:	PV	NPV	IRR	PV	NPV	IRR	PV	NPV	IRR
1 %	35,945	397,478	7.93	35,945	266,478	4.44	35,945	141,478	2.02
2 %	29,517	317,174	6.88	29,517	192,174	3.41	29,517	67,174	1.02
3 %	24,284	252,526	5.84	24,284	127,526	2.41	24,284	2,526	0.04
4 %	20,017	196,072	4.82	20,017	71,072	1.42	20,017	-53,928	-0.92
5 %	16,530	146,593	3.82	16,530	21,593	0.46	16,530	-103,407	-1.86
6 %	13,676	103,071	2.84	13,676	-21,929	-0.49	13,676	-146,929	-2.79
7 %	11,334	64,653	1.88	11,334	-60,347	-1.42	11,334	-185,347	-3.70
8 %	9,410	30,624	0.94	9,410	-94,376	-2.33	9,410	-219,376	-4.59
9 %	7,826	378	0.01	7,826	-124,622	-3.23	7,826	-249,622	-5.47
10 %	6,520	-26,595	-0.90	6,520	-151,595	-4.11	6,520	-276,595	--6.33

DRAFT

Table 8-7 looks at present value (PV), net present value (NPV) and internal rate of return (IRR) as a function of discount rate (from 1% to 10%) at 20 years for a range of medium bulk fuel boiler system investment costs.

Table 8-7. PV, NPV and IRR as a Function of Discount Rate for a Range of Medium Bulk Fuel System Investment Costs

Initial Investment	750,000			1,000,000			1,250,000		
Annual Savings	94,515			94,515			94,515		
Life Span	20			20			20		
Discount Rate:	PV	NPV	IRR	PV	NPV	IRR	PV	NPV	IRR
1 %	77,459	955,575	9.95	77,459	705,575	5.96	77,459	455,575	3.28
2 %	63,606	795,456	8.88	63,606	545,456	4.92	63,606	295,456	2.26
3 %	52,331	656,145	7.82	52,331	406,145	3.90	52,331	156,145	1.27
4 %	43,135	534,490	6.78	43,135	284,490	2.90	43,135	34,490	0.30
5 %	35,622	427,866	5.77	35,622	177,866	1.92	35,622	-72,134	-0.66
6 %	49,470	334,080	4.77	49,470	84,080	0.96	49,470	-165,920	-1.59
7 %	24,424	251,293	3.79	24,424	1,293	0.02	24,424	-248,707	-2.51
8 %	20,278	177,962	2.83	20,278	-72,038	-0.91	20,278	-322,038	-3.42
9 %	16,864	112,784	1.88	16,864	-137,216	-1.82	16,864	-387,216	-4.30
10 %	14,049	54,659	0.96	14,049	-195,341	-2.71	14,049	-445,341	-5.17

As this and other tables indicate, there is a strong relationship between project feasibility and size of the project (related to net annual savings). Feasibility improves as system size and savings increase.

SECTION 9. CONCLUSIONS

This report discusses conditions found "on the ground" at a number of Alaska Gateway School District facilities in the Tanana / Upper Copper Valleys in Interior Alaska, and attempts to demonstrate, by use of generic examples, the feasibility of installing high efficiency low emission wood-burning boilers for heating these AGSD facilities.

Wood is a viable heating fuel in a wide range of institutional applications, however, below a certain minimum and above a certain maximum, it may be impractical to heat with wood, or it may require a different form of wood fuel and heating system. The cost of heat ($ per MMBtu) derived from wood versus the cost of heat ($ per MMBtu) derived fuel oil is significant as illustrated in Table 5-1. It is this difference in the cost of heat, resulting in monetary savings, that must "pay" for the substantially higher investment and OM&R costs associated with wood-fuel systems.

9.1 "Small" Applications

Three of the AGSD facilities could be considered "small" in terms of their use of fuel oil, namely the AGSD Administrative Offices, the Dot Lake School and the Tanacross School. The fuel oil consumption estimates for these facilities ranges from 4,000 to 5,500 gallons per year and, depending on which set of financial projections one chooses to apply (Table 5-3), potential gross annual savings ranges from $4,600 to $14,050 per year per facility.

In the hypothetical example presented in Section 7 for a "small" facility, the gross annual savings would amount to $9,125, and yield a simple payback of 4.89 years (given a cordwood boiler installation costing $44,600). However, when annual OM&R costs are considered, the net present value and internal rate of return after 10 years, assuming a discount rate of 5%, are -$1,225 and -0.54% respectively. While these results do not necessarily make the project unfeasible, they do indicate the economy of scale may be marginal at the assumed discount rate and time period. However, at a lower discount rate or longer time period both NPV and IRR are positive at or just beyond the 10-year mark.

9.2 "Medium" Applications

Two of the AGSD facilities could be considered "medium" in terms of their fuel oil consumption, namely the Mentasta Lake School and the Tetlin School. Fuel oil usage at these facilities was estimated at 12,000 to 15,000 gallons per year (the average figure of 13,500 gpy was used in some calculations). Referring again to Table 5-4, the potential gross annual savings ranges from $14,700 to $34,550 per year.

In the hypothetical example presented in Section 7 for a "medium" facility, which is assumed to consume 15,000 gpy, the gross annual savings would amount to $27,500, and yield a simple payback of 3.73 years (given a cordwood boiler installation costing $102,520). When annual OM&R costs are considered, the net present value and internal rate of return after 10 years, assuming a discount rate of 5%, are $67,590 and 11.46% respectively. These results indicate that, under the assumed conditions, the project is economically viable.

9.3 "Large" Applications

The Northway School and the Tok School (combined with the Multi-Purpose Facility) could be considered "large" in terms of their fuel oil consumption. The Northway School is estimated to use 25,000 gpy, and the Tok School/MPF is estimated to use 45,000 to 50,000 gallons per year.

9.3.1 Northway School

At 25,000 gpy, the Northway School is be a potential candidate for either a cordwood or bulk fuel system. Both options were considered in this report.

Referring again to Table 5-4, the potential gross annual savings ranges from $27,250 to $64,000 for a cordwood system, and $35,750 to $71,450 for a bulk fuel system.

In the hypothetical example presented in Section 7 for a "large" cordwood facility, which is assumed to consume 25,000 gpy, the gross annual savings would amount to $45,625, and yield a simple payback of 2.96 years (given a cordwood boiler installation costing $134,970). When annual OM&R costs are considered, the net present value and internal rate of return after 10 years, assuming a discount rate of 5%, are $161,738 and 19.56% respectively. These results indicate that, under the assumed conditions, the project is economically viable.

In the hypothetical example presented in Section 8 for a "small" bulk fuel facility, which is assumed to consume 25,000 gpy, the gross annual savings would amount to $53,600 and yield a simple payback of 7.46, 9.79 and 11.19 years given initial investment costs of $400,000, $525,000 and $650,000, respectively. Using the middle value ($525,000) and a discount rate of 5%, at 10 years the NPV would equal -$186,325 and the IRR would equal -7.75%. The picture improves after 20 years, with the NPV equal to $21,593 and the IRR = 0.46%. While these results do not necessarily make the project unfeasible, they do indicate the economy of scale may be marginal at the assumed discount rate and time period.

9.3.2 Tok School and Multi-Purpose Facility

A facility using 50,000 gpy is beyond the upper limit of what is physically practical, in terms of heating with cordwood. At an estimated consumption twice that of the Northway School, the operator would have to load, and the system would have to consume, nearly 2¼ cords of wood per day. For this reason, the Tok School and MPF, as one facility, is considered a candidate for a bulk fuel system.

In the hypothetical example presented in Section 8 for a "medium" bulk fuel facility, which is assumed to consume 50,000 gpy, the gross annual savings would amount to $108,880 and yield a simple payback of 6.89, 9.18 and 11.48 years given initial investment costs of $750,000, $1,000,000 and $1,250,000, respectively. Using the middle value ($1,000,000) and a discount rate of 5%, at 10 years the NPV would equal -$270,180 and the IRR would equal -5.73%. The picture improves after 20 years, with the NPV equal to $177,866 and the IRR = 1.92% (both NPV and IRR become positive in year 16). These results indicate that, under the assumed conditions, the project is economically viable and worthy of further consideration.

FOOTNOTES:

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[2] Briggs, David, 1994. *Forest Products Measurements and Conversion Factors*, University of Washington Institute of Forest Resources, AR-10, Seattle, Washington 98195.

[3] Wood with moisture greater than about 67% MC will not support combustion. *Wood-Fired Boiler Systems For Space Heating*, USDA Forest Service, EM 7180-2, 1982.

[4] Feasibility Assessment for Wood Heating, T.R. Miles Technical Consultants, Inc., Portland, OR, 2006. http://www.jedc.org/forms/AWEDTG_WoodEnergyFeasibility.pdf

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[6] Proposal For A Particulate Matter Emissions Standard And Related Provisions For New Outdoor Wood-fired Boilers, Vermont Agency of Natural Resources Department of Environmental Conservation Air Pollution Control Division January 20, 2005 (revised July 6, 2005) http://www.vtwoodsmoke.org/pdf/TechSupp.pdf

[7] http://www.nescaum.org/topics/outdoor-hydronic-heaters/other-model-regulations

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[9] Assessment of Outdoor Wood-Fired Boilers, Revised May 2006, NESCAUM, the Clean Air Association of the Northeast States http://www.nescaum.org/documents/assessment-of-outdoor-wood-fired-boilers

[10] Electronic Code of Federal Regulations, Title 40, Protection of Environment, Part 60, Standards of Performance for New Stationary Sources. http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&sid=f0d500634add4f17c656e9d55ce0d0cf&rgn=div6&view=text&node=40:6.0.1.1.1.63&idno=40

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[13] http://www.tarmusa.com, Tarm USA Inc. P.O. Box 285 Lyme, NH 03768

[14] http://www.dectra.net/garn, Dectra Corporation, 3425 33rd Ave. NE, St. Anthony, MN 55418

[15] Test of a Solid fuel Boiler for Emissions and Efficiency per Intertek's Proposed Protocol for Outdoor Boiler Efficiency and Emissions Testing. Intertek report No. 3087471 for State of Michigan, Air Quality Department. Intertek Testing Services NA Inc. 8431 Murphy Drive, Wisconsin 53562. March 2006.

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[17] Biomass Boiler Market Assessment, CTA Architects and Engineers, Christopher Allen & Associates, Montana Community Development Corp., and Geodata Services, Inc. 2006. http://www.fuelsforschools.org/pdf/Final_Report_Biomass_Boiler_Market_Assessment.pdf

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Appendix A. AWEDTG Evaluation Criteria

The following criteria were used to evaluate and recommend projects for feasibility assessments:

1. The opportunity for displacing fuel oil, natural gas, propane or diesel-generated electricity used by targeted facilities for heating needs (i.e., current fuel type, gallons of fuel per year, annual cost per year);

2. Local presence of high-hazard forest fuels and potential for utilizing these fuels for heating schools, other public facilities, and buildings owned and operated by not-for-profit organizations;

3. Availability of local wood processing residues (e.g., sawdust, planer shavings, and sawmill residues);

4. Project cost versus yearly savings (cost-effectiveness);

5. Sustainability of the wood fuel supply;

6. Community support and project advocacy;

7. Ability to implement the project;

8. Ability to operate and maintain the project.

Appendix B. Recoverable Heating Value Determination

The Recoverable Heating Value (RGV) of wood is equal to the Gross Heating Value minus various energy losses (H1 through H8). Those losses are described as:

H1: Heat used to raise the temperature of water in the wood to the boiling point

H2: Heat required to vaporize the water in the wood

H3: Heat require to separate the bound water (water below fiber saturation point) from the cell walls

H4: Heat required to raise the temperature of the vaporized water to the temperature of the exhaust gases

H5: Heat required to evaporate water that forms when the hydrogen component of wood is combusted

H6: Heat from combustion other than water vapor (dry gases)

H7: Heat required to raise the temperature of wood to the combustion temperature

H8: Other heat losses (radiation, conduction, convection, incomplete combustion, etc.)

Each of these energy loss factors is a calculated value based on published formulae. For more information, please refer to: Briggs, D.G., *Forest Products Measurements and Conversion Factors* (Chapter 9), College of Forest Resources, University of Washington, 1994

In order to calculate RHV, certain factors must be known or assumed. In calculating RHV for this paper, the following assumptions were made (as per Example 1 in Briggs' publication):

- Higher Heating Values (HHV): as presented in Table 1
- Moisture Content (MC): water content (calculated on wet basis). For calculations involving cordwood, moisture (water) content was assumed to be 20 percent on a wet basis. For calculations involving bulk fuel, moisture (water) content was assumed to be 40 percent on a wet basis.
- Wood Content: 100 minus moisture content percent (calculated on wet basis). For calculations involving cordwood, wood content was assumed to be equal to 80 percent. For calculations involving bulk fuel, wood content was assumed to be equal to 60 percent.
- Ambient Temperature (T1): assumed to be 70 degrees F
- Exhaust Temperature (T2): assumed to be 470 degrees
- Combustion Temperature (T3): assumed to be 450 degrees F
- Fiber Saturation Point (FSP): assumed to be 23 percent (calculated on a wet basis), which is equal to 30% calculated on a dry weight basis
- Excess Air (EA): assumed to be 20 percent
- Other Losses (OL): assumed to be 4 percent

Appendix C. List of Abbreviations and Acronyms

AEA	Alaska Energy Authority
AWEDTG	Alaska Wood Energy Development Task Group
BDT	Bone Dry Ton
BTU	British Thermal Unit (MBtu, thousand Btu ; MMBtu, million Btu)
CE	Conversion Efficiency (fuel to heat)
CHP	Combined Heat and Power
CO	Carbon Monoxide
Cord	80 ft3 of solid wood; 100 cubic feet of "fuel" (wood + bark)
CR	Cost Recovery; years to recover investment at indicated interest rate
DB	Dry Basis (wet weight –dry weight/dry weight * 100)
DD	Degree Days (Heating Degree Days)
EPA U.S.	Environmental Protection Agency, U.S.
GHV	Gross Heating Value
Gm	Gram
Gpy	Gallons per year
HHV	Higher Heating Value
JEDC	Juneau Economic Development Council
KBtu	Thousand Btu
KWe	Kilowatts, electric
KWt	Kilowatts, thermal
MC	Moisture Content (e.g. MC20 20 % moisture)
MBtu	Thousand Btu (also kBtu)
MMBtu	Million Btu
NHV	Net Heating Value
NPV	Net Present Value
OD	Oven Dry
ODT	Oven Dry Ton
O&M	Operating and Maintenance
OM&R	Operation, Maintenance and Repair
OWB	Outdoor Wood Boiler
POW	Prince of Wales [Island], Alaska
PV	Present Value
RHV	Recoverable Heating Value
Unit	A shipping volume of 200 ft3
WB	Wet basis (wet weight-dry weight/wet weight * 100)

1 grams = 0.00220462262 pounds
1 pounds = 453.59237 grams

Friday December 28, 2007

KMW

Biomass

- » **Introduction to Biomass**
- » Benefits
- » Supply

Biomass is organic matter that through the combustion process can be transformed into usable energy – Bioenergy.

The following are examples of biomass materials and where it could be sourced:

- Plant materials
- Residues from forest industries, forest floor
- By-products from wood remanufacturing
- Agricultural residues and waste products
- Municipal and industrial wastes (where the organic material is biological in origin; this would include wastewater treatment sludge or biosolids from pulp and paper and municipal sewage plants)
- Residues from rendering plants, ethanol/biodiesel production plants
- Construction sites, land clearings
- Husks/shells from grains, peanuts, walnuts, cotton seeds
- Peel from citrus fruits

Biomass Fact:

Worldwide, biomass is the fourth largest energy resource after coal, oil, and natural gas.

Bioenergy is a carbon-neutral, environmentally friendly, sustainable energy source that has proven potential to relieve a significant portion of our reliance on fossil fuels. In North America energy from Biomass is critically underutilized and represents a tremendous opportunity for industry and individuals to take control of energy production costs and environmental impacts.

With the continuing rise in the cost of fossil fuels and concern over the environmental impact of our increasing energy consumption, energy from Biomass is increasingly recognized as the anchor for a strong future in renewable energy production. There is an abundance of resources available in North America and the availability of suitable and underutilized farmland fit for the growth of energy crops make the potential for Bioenergy to positively impact global warming and economic growth incredible.

Bioenergy can also turn the increasing problems with municipal waste in our cities into economic benefits and make a significant contribution to energy production. With proper sorting and an efficient, a state-of-the-art Waste-to-Energy plant can reduce the strain on our overfilled landfill sites while producing energy with emissions that easily fall within the most stringent guidelines in Canada. Europe is at the forefront of Waste-to-Energy production and North America is well on it's way to embracing the idea as the proven benefits continue to roll in from the ongoing studies and the old notions of incinerations plants melt away opening up to clear understanding of today's technology.

Friday December 28, 2007

KMW

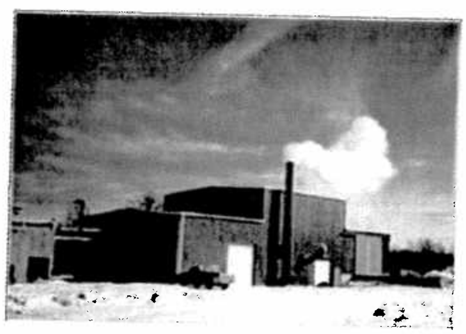
Corporate Profile

- Company Profile
- Research & Development

Biomass Fact:

Worldwide, biomass is the fourth largest energy resource after coal, oil, and natural gas.

From the beginning of KMW's independent operations in Canada in 1987 we have worked to refine and expand on the possibilities of our combustion technology for biomass fuels. Starting with the lumber industry, KMW has worked with numerous customers across Canada and in the United States employing well developed, industry leading bioenergy systems that have fuelled the success of not only the mills in which they are installed but also the communities in which they are located. From there KMW branched out to show Canadians the immediate possibilities for implementation of biomass energy, such as district heating, greenhouses, and institutional and industrial energy supply. KMW systems have been installed in hospitals and schools, manufacturing plants and even supplies year round heat energy to a whole village in Northern Quebec.



KMW is a constant participant in energy and environmental issues and in events assisting to facilitate the growth of renewable energy use in Canada. Government and educational institutions rely upon us to contribute ideas and expertise on bioenergy. KMW is a proud member of the team working with BIOCAP to define Canada's path to develop a world class, sustainable bioenergy industry in Canada.

KMW works closely with our clients project management teams, engineering staff and professional advisors to evaluate and implement biomass energy projects. KMW has met and exceeded the requirements of Fortune 500 companies time and time again, delivering customized bioenergy systems. We strive to establish life long relationships with our customers and their communities by providing systems with a service life in excess of 25 years.

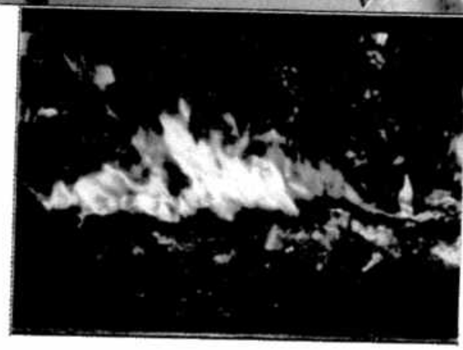
KMW is dedicated to the use, growth, sustainability, and responsible use of biomass energy.

Friday December 28, 2007

KMW

Corporate Profile

- » Company Profile
- » **Research & Development**



KMW's response to the need for greater biomass fuel flexibility is our continuing efforts in research and development to enhance our combustion technology. These efforts have resulted in the installation of a specially designed combustion system at the Canmet Energy Technology Centre in Ottawa. This combustion system is dedicated to research through trials on different types of biomass materials. Ongoing collaboration with researchers at NRCan/Canmet and also with McGill University, Montreal, QC, assists us to continuously enhance our combustion technology resulting in lower emissions, higher performance and greater efficiency. Our R&D program also aims at developing new applications for biomass energy, for thermal as well as electrical generation.

One research project had the objective to find a more efficient and cost effective solution for reducing emissions from the combustion of biomass. The success of this innovative project resulted in a new and patented design. Joint research has also been conducted with McMaster University in Hamilton, ON, and Queen's University in Kingston, ON, in other exciting areas of bioenergy.

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Friday December 28, 2007

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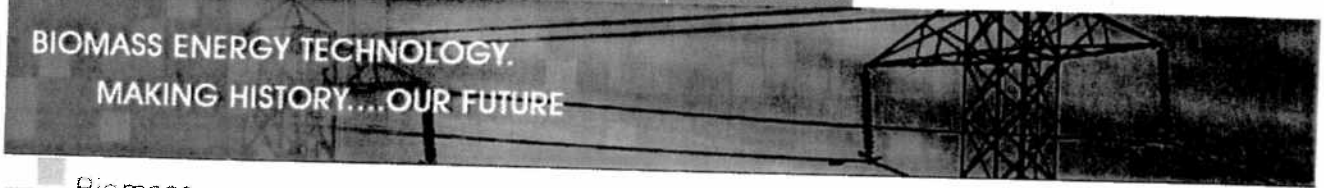

Biomass

Biomass Fact:

Total Energy Savings for our Clients :

$170 million per year

There are numerous reasons why you should use a KMW bioenergy system instead of traditional sources:

- **Stability** – our energy systems provide you with low and predictable energy costs.
- **Clean** - environmentally friendly, carbon-neutral energy production for thermal heating, steam and electricity generation.
- **Guaranteed Performance** - systems are competitively priced and guaranteed to perform to specified levels.
- **Economical** - system payback is usually between 1-3 years with savings up to 40% on energy costs when compared to fossil fuels.
- **Efficiency** - designed for operating flexibility, low operational manpower, low maintenance & long-term reliability.
- **Financial Beneficial** - depending on the waste produced, expensive disposal costs can be transformed into a fuel source and in the case of electricity production there is the potential for additional revenue streams.
- **Adaptability** – older, existing boilers in many cases can be converted to biomass fired boilers saving significant time and expense
- **Fuel flexibility** – our custom designs allow our Biomass Energy Systems to accept the largest range of fuel types and mixtures and can be re-adjusted over time to accommodate changes in your fuel and loads.
- **Proven experience** – with over 100 KMW installations world-wide in a wide variety of industries and applications you can feel comfortable that you are dealing with experts at the forefront of the biomass energy industry.
- **Customization** - each system is custom designed and engineered to fit the unique needs and environment of your operations to maximize results.
- **Support** – KMW provides a complete spare part & service department for all your systems needs, as well as an experienced, well-trained staff to answer your questions and assist you from your first call through the entire life of

your system.

- **Commitment** – KMW is firmly committed to biomass as an anchor technology in the furthering of renewable energy production in Canada and is a proud participant in the BIOCAP initiatives as well as constantly developing its own technology and knowledge through ongoing research and development.
- **Pride** – a real made in Canada solution that is Kyoto compliant.

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KMW®

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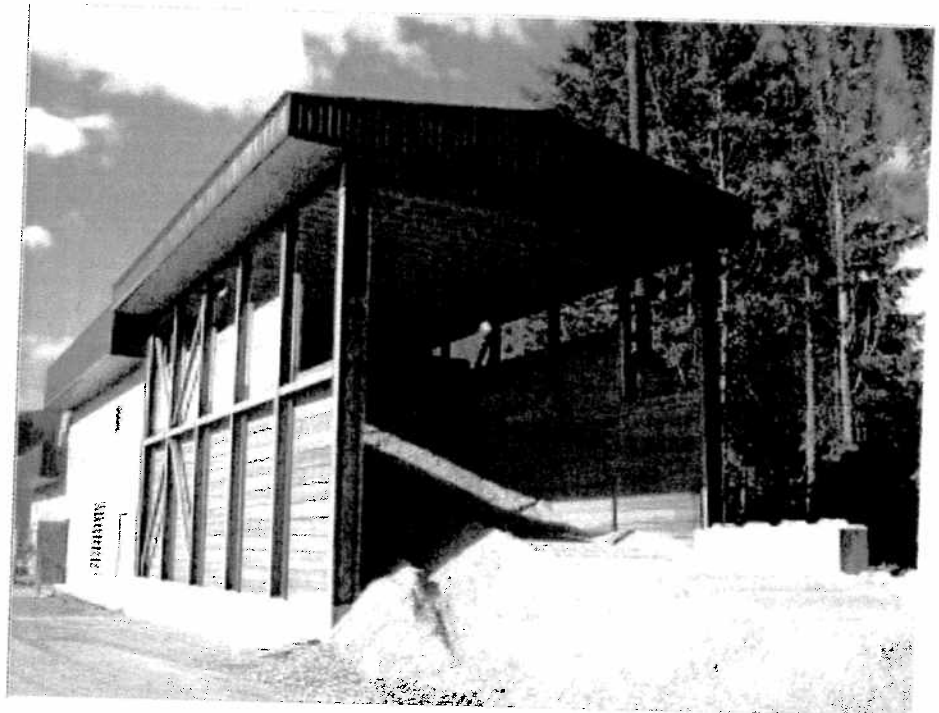
Biomass

- » Introduction to Biomass
- » Benefits
- » **Supply**

Biomass Fact:

Biomass can produce electricity, heat, liquid fuels, gaseous fuels, and a variety of useful chemicals, including those currently manufactured from fossil fuels.

KMW recognizes that some clients have limited knowledge and experience in securing suitable biomass fuel. To assist our customers in this, KMW has introduced the KMW Biomass supply program. Under this program KMW will use its vast knowledge and experience and enter into a fuel supply contract where we will take on the responsibility to supply the biomass. KMW Biomass is constantly researching new biomass sources and through blending can "engineer" fuels to bring an even greater value, efficiency and comfort to our customers.



Fuel Storage Silo

Home Company Biomass Solutions News & Events Contact

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Energy Solutions

- » **Energy Generation**
- » How it Works
- » Case Studies & Testimonials

Biomass Fact:

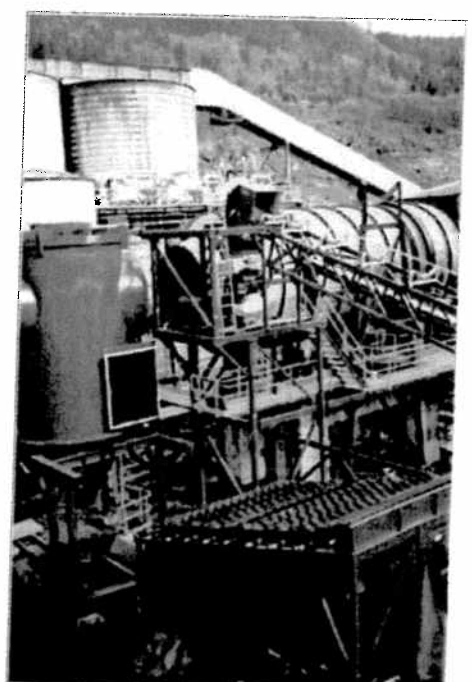
Worldwide, biomass is the fourth largest energy resource after coal, oil, and natural gas.

KMW Bioenergy Systems are custom designed and engineered to suit your project requirements. With our TRF and SRF models, energy output can range between 250 Boiler HP (2.5 MWt) to 4,000 Boiler HP (40 MWt) and is available in configurations for hot water, low or high pressure steam, thermal oil and hot gas for drying applications. For greater energy generations and/or operating flexibility, multiple systems can be supplied. Additional flexibility comes from the variety of biomass sources the system can accommodate, from bone-dry sawdust to wet organic sludge.

KMW System Advantages:

- Modular design based on standard components, for easy maintenance
- Designed for smooth installation and startup
- Quality control throughout fabrication process
- Most components are fitted and tested in the shop

Like our systems, our scope in your project can be tailored to suit your needs, from equipment supply to turnkey systems.



Combustion Chamber Floor During Assembly

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Energy Solutions

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- » **How it Works**
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Biomass Fact:

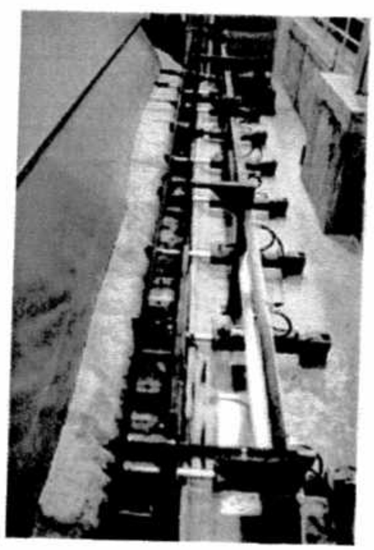
Total Energy **Savings** for our Clients :

$170 million **per year**

KMW Bioenergy Systems are typically constructed in 6 major sections (can be supplied in sections or as a whole).

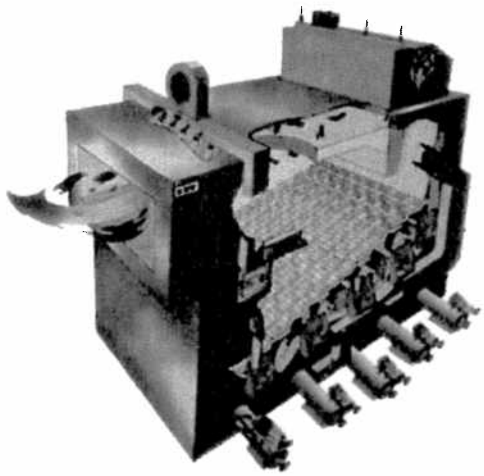
- **Fuel Handling**
- **Combustion System**
- **Energy Recovery (Boiler)**
- **Ash Handling**
- **Emission Control**
- **Computerized Control System**

Fuel Handling



The fuel handling involves extraction of biomass from a storage and then transported to the fuel metering bin adjacent to the combustion system. The equipment to reclaim the fuel from the storage is of the live bottom floor design pioneered and patented by our previous parent company. The floor stokers are powered by a hydraulic system and its sturdy design has proven to be very reliable with low maintenance requirements. The fuel transport system includes conveyors of screw (auger), chain or belt type depending on the fuel feed rate and size characteristics of the material.

Combustion System



Fuel is metered automatically into the combustion system, which features a sloping grate floor. The fuel is then evenly distributed on the grates where our unique reciprocating grate design gently advances and agitates the fuel down the slope. The carefully designed refractory lining in the combustion chamber acts as a heat sink (thermal flywheel) and heat reflector to maintain the proper cell temperature to remove any moisture present in the fuel and to sustain the gasification process. Moisture evaporates and volatile gas is released. Secondary (overfire) air is injected to initiate the second stage combustion. Primary (underfire) air mixes with the remaining fixed carbons (charcoal) to complete the combustion process.

Our unique grate cycling pattern creating the optimum fuel bed profile together with complete combustion air control achieves the highest degree of efficiency resulting in minimal emissions.

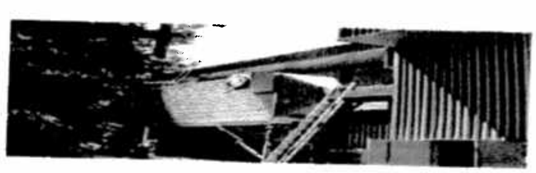
Energy Recovery (Boiler)

Heat generated by the combustion system in the form of a hot fluegas is transferred to the appropriate medium (hot water, steam or thermal oil) in the heat recovery unit for use in space heating, process or electric generation. KMW boilers are selected for long, dependable service life.

Ash Handling

Collected fly ash together with grate ash is transferred by ash handling conveyors and deposited into a container. The fully automatic ash handling system guarantees a safe and clean operation.

Emission Control System



Multicyclones, wet scrubbers, and electrostatic precipitators can be utilized for emission control. The emission control system is carefully selected to meet relevant regulations and protect our environment.

Control System

The computerized control system efficiently controls and monitors all components of the entire system. It allows the operator to easily modify parameters and setpoints to adjust for changes in the fuel characteristics to maintain a high performance.

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KMW

Energy Solutions

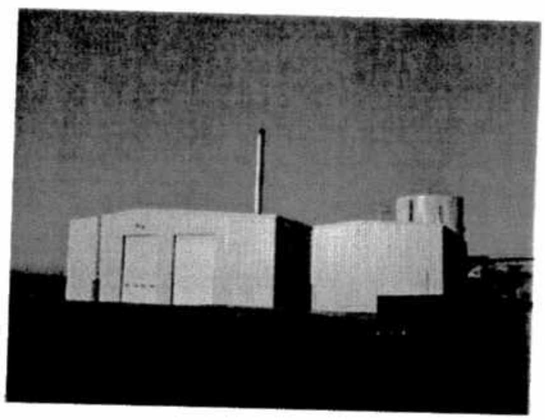
- » Energy Generation
- » How it Works
- » **Case Studies & Testimonials**
- Foothill Greenhouses Ltd
- Taylor Lumber Co. Ltd.
- Ouje Bougoumou Village
- Spruce Falls Inc
- Campbellton Hospital

Biomass Fact:

Biomass can produce electricity, heat, liquid fuels, gaseous fuels, and a variety of useful chemicals, including those currently manufactured from fossil fuels.

Greenhouse - Foothill Greenhouses Ltd. (Kettleby, Ont)

In the spring of 2001, Foothill Greenhouses installed a 600 Boiler HP (6 MWt) KMW bioenergy system. The system produces hot water heating for the greenhouses where the heated water is circulated through a piping system and returns to the boiler for re-heat. The wood chips is trucked in from local sources. KMW custom designed the bioenergy system to fit into the existing building layout.



In 2004 the customer decided to install a second identical system to further reduce their dependancy on natural gas and enjoy greater fuel cost savings.

Escalating energy cost was the driving force behind Foothill Greenhouses' decision to invest in two KMW bioenergy systems. The systems produce approximately 95% of their total heat demand. The existing natural gas fired boiler is only operated for CO_2 production and to provide backup. With the displacement of two million cubic metres of natural gas per year, Foothill Greenhouses has not only succeeded in stabilizing their unpredictable energy costs but also created a positive impact on the environment.

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Biomass Fact:

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Sawmill - Taylor Lumber Co. Ltd. (Middle Musquodoboit, NS)

Taylor Lumber Co. Ltd. produces 8-10 million board feet per year of kiln dried and heat-treated lumber. The mill began operation in 1946 with the sawing of rough lumber and in later years developed a planing mill operation to finish the lumber to greater tolerances. The company decided to expand in 1993, which included a KMW bioenergy power plant. The system not only supplies steam for the kilns but also produces all of the power required for their operation. Any surplus of energy created is sold to the local utility company.

When the new sawmill was constructed, production of biomass fuel was increased to 90% to suit the power plant's needs with the balance trucked in. The bioenergy system produces 20,000 lbs/hr of saturated steam at 230 psig. Approximately 21-25,000 wet tons of wood residue is consumed annually. Taylor Lumber currently produces approximately 1 MW of electric power in addition to steam for kiln drying.

Taylor took advantage of the KMW bioenery system and changed their waste into valuable energy, thermal and electric, which in turn improved profits for the mill.

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Biomass Fact:

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District Heating - Ouje Bougoumou Village (Ouje Bougoumou, QC)

Ouje Bougoumou is a village located in Northern Quebec with a world-renowned district heating system. The native community, built during the 1990's, decided to use the concept of shared heating for the entire village. All heat consumers, from individual houses to public facilities such as offices, schools, medical clinic, etc. are connected to the central heating plant through underground hot water pipes.

When first constructed in 1992, the central heating system was equipped with a 1 MW KMW bioenergy system. An additional 1 MW oil fired boiler was installed for use during peak demand and as back up. As the village grew, another oil-fired boiler was added. In the fall of 1998 a second bioenergy system was installed and commissioned in January 1999. The newer system has a 1.7 MW heat capacity. The two bioenergy systems work together to provide enough heat for the entire village, even during peak periods. The sawdust is purchased from a local sawmill and transported using trucks owned by the village.

The two bioenergy systems have allowed the village more operating flexibility. During the summer time when the demand for heat is naturally lower, the smaller system will carry the load and during winter the two systems operate together. At peak demand the two systems consume approximately 25 tons of wood residue per day.

The forward thinking community of Ouje Bougoumou, has not only enjoyed the economic return on their investment in bioenergy but the substantial environmental benefits, not to mention a significant boost in employment, skills training, and pride in the community from producing their own energy.

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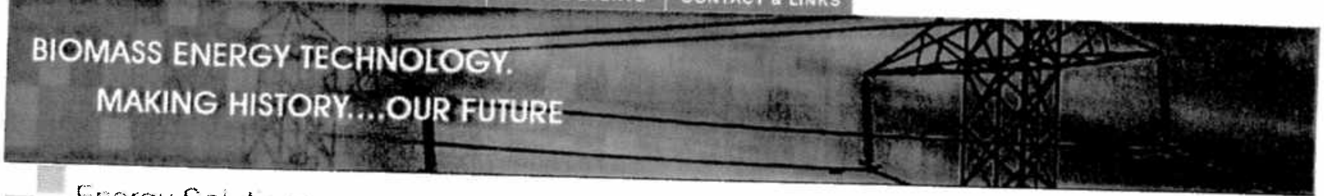

Energy Solutions

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Biomass Fact:

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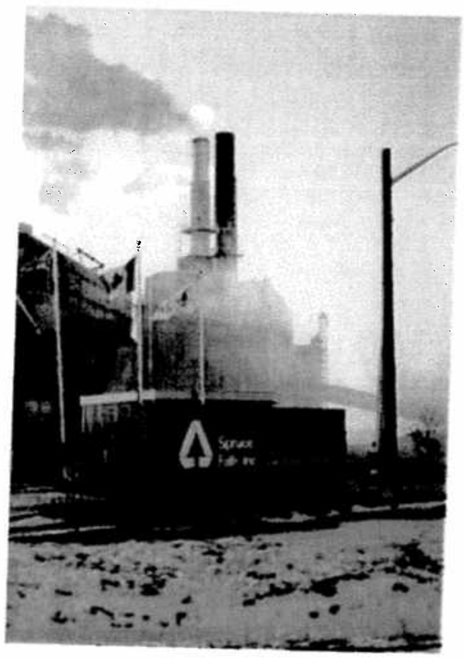
Pulp & Paper - Spruce Falls Inc. (Kapuskasing, ON)

The Spruce Falls mill produces approximately 377,000 metric tons of quality newsprint and specialty papers and 114 million board feet of stud lumber on an annual basis.



As wastewater treatment became necessary, sludge was produced as part of the process. Initially, primary sludge was burned with the wood waste, but with the introduction of coated paper de-inking and secondary wastewater treatment, the sludge had to be land filled. Spruce Falls started looking for a more long-term solution to meet the latest environmental commitments, and the combustion of sludge, together with heat recovery, became the best alternative.

The project involved three new shop assembled KMW bioenergy combustion systems each coupled to a shop assembled package steam boiler mounted directly above the combustion system. A common electrostatic precipitator is used for emission control and designed for a maximum of 20 mg/Nm3 of particulate emission. The steam boilers with a total capacity of 240,000 lbs/hr are designed for 900-psig super-heated steam to 900F for future power generation.

At design point, the plant burns approximately 1,000 wet tons of biomass per day. Primary sludge, secondary sludge and de-inking sludge is de-watered in a screw press to 70% moisture content. The sludge is approximately 27% of the fuel mixture with the balance consisting of bark and mill residue.

The project was completed in less than 12 months from purchase order to steam production and was commissioned in October 1998.

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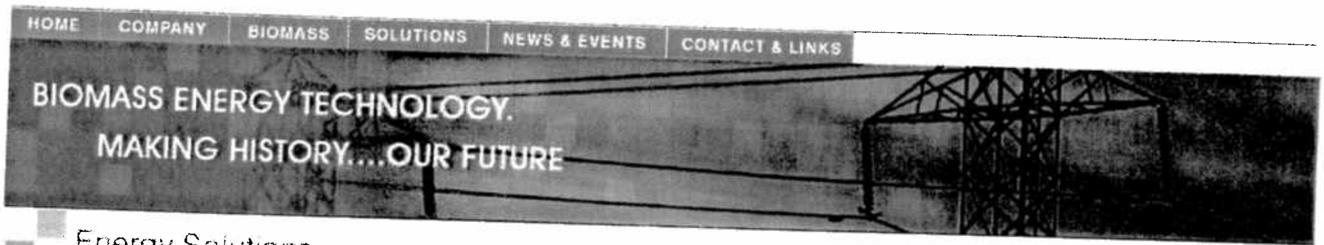

Energy Solutions

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Institutional - Campbellton Regional Hospital (Campbellton, NB)

Campbellton Regional Hospital was constructed during the mid 1980's. The provincial government was keen on reducing operational costs as well as promoting the use of biomass energy, which prompted their decision to install a KMW bioenergy system at the hospital.

The high-pressure steam boiler was installed in 1987 with a heat capacity of 10 million Btu/hr (3 MWt). and oil fired boilers were installed to assist during peak demand. The biomass system consumes approximately 40 wet tons of wood residues per day that the hospital purchases from a nearby sawmill. The control system was upgraded in 2000 to increase boiler efficiency and further reduce operating costs.

The steam demand remains constant throughout the year, which provides an excellent return on their investment. A large number of institutions including hospitals and schools have successfully incorporated KMW Bioeneregy Systems into their existing steam plants.

Biomass Fact:

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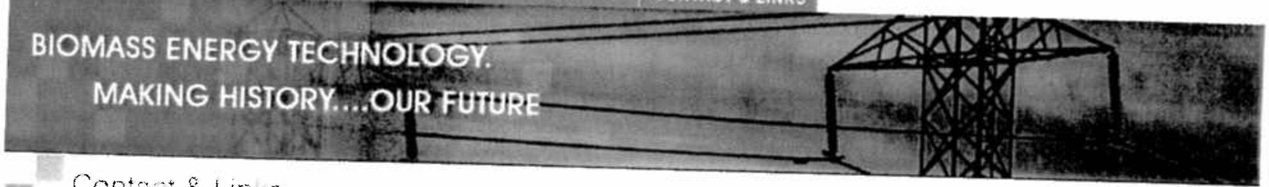


Contact & Links

- » **Contact Page**
- » Additional Links

For futher information about what KMW could do for your operation's energy needs with Bioenergy System please use the contact form below:

Name:

Email:

Phone: (optional)

Message:

clear | Send Email

Corporate Headquarters

3330 White Oak Rd.
London, Ontario
N6E 1L8 Canada
Tel: 519-686-1771
Fax: 519-686-1132

Home Company Biomass Solutions News & Events Contact

THREE PASS FIRETUBE COMPACT BOILERS

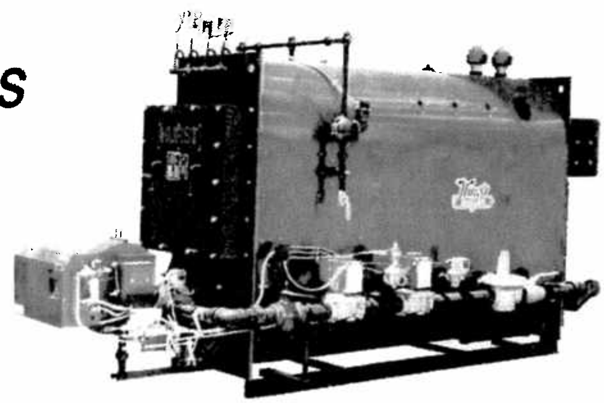
■ HURST "PERFORMANCE" BOILERS ■

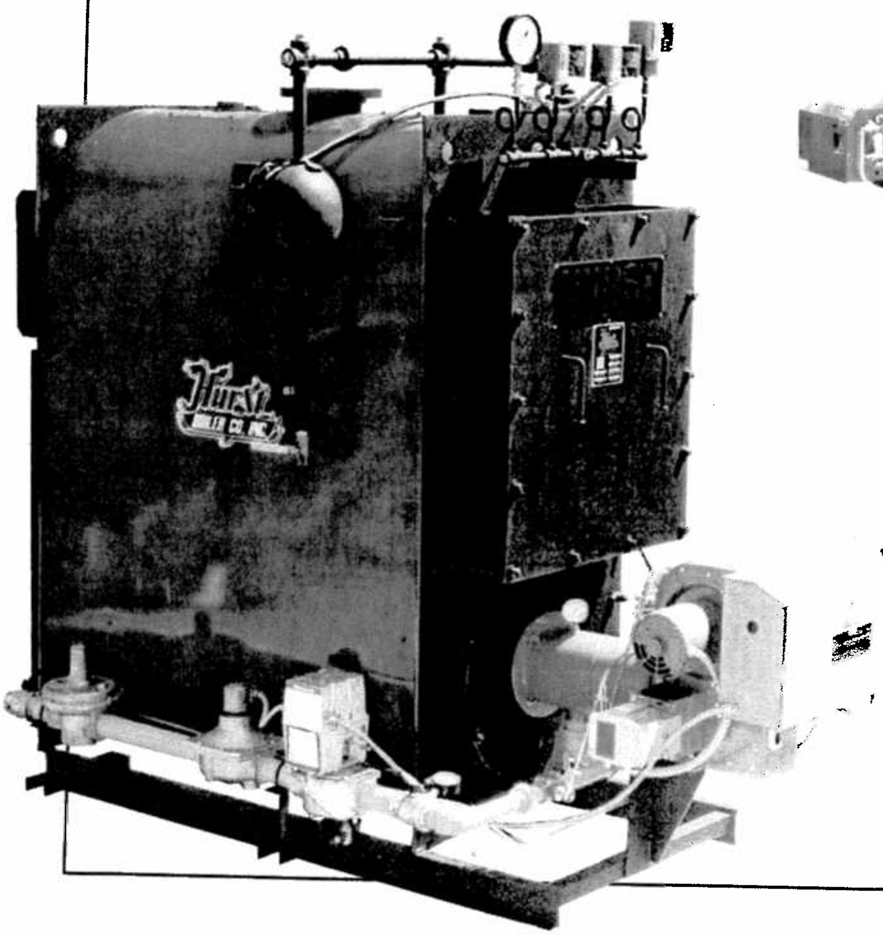
LPE SERIES

THROUGH THE DOOR DESIGN!

Available with...LOW NOx

HEAVIEST DESIGNED BOILER IN ITS CLASS





Capacities From

20 to 100 HP

670 to 3,348 MBTU/HR.

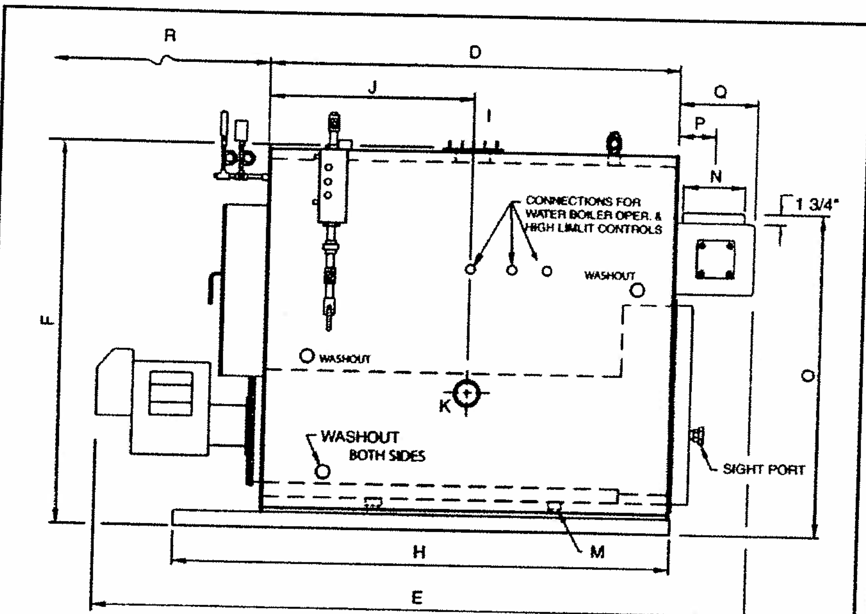
15 PSI Steam
30 PSI Water
[60 PSI Water Optional]

UL Approved Forced Draft Burners

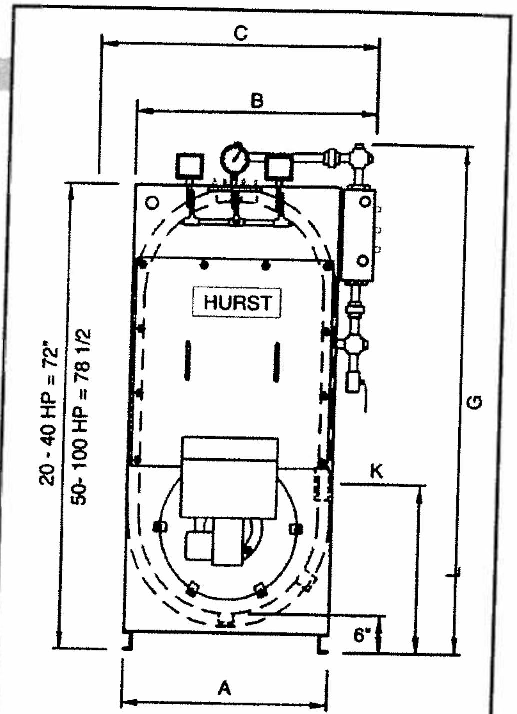
Designed, constructed and stamped in accordance with the requirements of the ASME Boiler Codes.

Inspected and registered with the National Board of Boiler & Pressure Vessel Inspectors.

Hurst BOILER & WELDING COMPANY, INC



SIDE VIEW



FRONT VIEW

BOILER SPECIFICATIONS

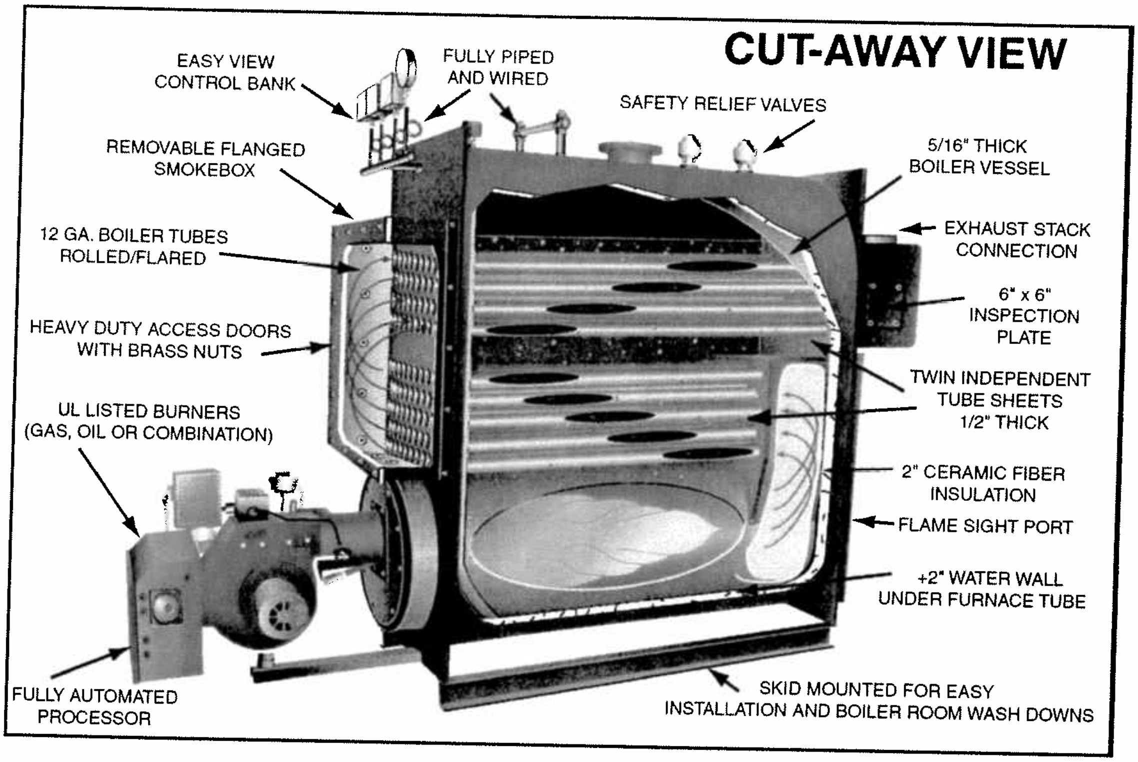
(ALL DIMENSIONS ARE IN INCHES)

DIMENSIONS SUBJECT TO CHANGE WITHOUT NOTICE. CERTIFIED DRAWINGS AVAILABLE UPON REQUEST.

	BOILER HORSEPOWER			20	30	40	50	60	70	80	100
	HEATING SURFACE	FIRESIDE	SQ.FT.	100	132 1/2	165 1/2	200	246	291	336	400
	STEAM OUTPUT FROM & @212° F		LBS/HR	690	1035	1380	1725	2070	2415	2760	3450
	MBH OUTPUT			670	1004	1339	1674	2009	2343	2678	3348
	FIRING RATE, GAS	1,000 BTU	CFH	840	1260	1680	2100	2520	2940	3360	4200
	FIRING RATE, #2 OIL	140,000 BTU	GPH	6	9	12	15	18	21	24	30
A	WIDTH WITHOUT TRIM		IN	31	31	31	34 1/2	34 1/2	34 1/2	34 1/2	34 1/2
B	WIDTH WITH TRIM		IN	38	38	38	42	42	42	42	42
C	WIDTH WITH GAS TRAIN		IN	49	49	49	52	52	52	52	52
D	BOILER LENGTH		IN	37	49	61	55	67	79	91	106
E	OVERALL LENGTH	STD. BURNER	IN	86	98	114	111	123	140	152	169
F	SUPPLY HEIGHT		IN	71 1/2	71 1/2	71 1/2	76 5/8	76 5/8	76 5/8	76 5/8	76 5/8
G	HEIGHT WITH TRIM		IN	79	79	79	86	86	86	86	86
H	LENGTH OF SKID		IN	54	66	78	72	84	96	108	123
I	SUPPLY SIZE		IN	4	4	4	* 6	* 6	* 6	* 6	* 6
J	SUPPLY LOCATION		IN	18 1/2	24 1/2	30 1/2	27 1/2	33 1/2	39 1/2	45 1/2	50 1/2
K	RETURN SIZE		IN	4	4	4	4	4	4	4	4
L	RETURN LOCATION		IN	27 1/4	27 1/4	27 1/4	32	32	32	32	32
M	BOILER DRAIN SIZE		IN	1	1	1 1/4	1 1/4	1 1/4	1 1/2	1 1/2	1 1/2
N	STACK DIAMETER, O.D.		IN	10	10	10	12	12	12	12	14
O	STACK HEIGHT		IN	60 1/4	60 1/4	60 1/4	67 1/4	67 1/4	67 1/4	67 1/4	67 1/4
P	TO CENTER OF STACK		IN	6 7/8	6 7/8	6 7/8	8 1/4	8 1/4	8 1/4	8 1/4	9 1/4
Q	REAR SMOKEBOX DEPTH		IN	13 3/4	13 3/4	13 3/4	15 3/4	15 3/4	15 3/4	15 3/4	17 3/4
R	TUBE PULL SPACE		IN	38	50	62	56	68	80	92	107
	SHIPPING WEIGHT		LBS	2952	3670	4332	4342	5046	5875	6597	7464
	WATER CONTENT - WATER	FLOODED	GALS	141	191	245	255	313	394	434	508
	WATER CONTENT - STEAM		GALS	120	163	209	194	239	306	333	390
	BOILER HORSEPOWER			20	30	40	50	60	70	80	100

CONNECTIONS FOUR INCHES AND SMALLER ARE FEMALE THREAD, 6" CONNECTIONS ARE 150 LB. FLANGES. * STUDDING FLANGE.

LOW PRESSURE
THREE PASS BOILERS



STANDARD EQUIPMENT

BOILER: Three pass design for 15 psi steam or 30 psi water (optionally available for 60 psi water). Factory assembled with trim, tested, ASME code, UL, and CSD-1 standards.

STEAM TRIM: Kunkle safety relief valve, operating pressure control, high limit pressure control with manual reset, 4 1/2" steam pressure gauge with syphon and test cock, combination pump control and low water cut-off with gauge glass assembly and drain valve, auxiliary low water cut-off with manual reset.

WATER BOILER TRIM: Kunkle safety relief valve, operating temperature control, high limit temperature control with manual reset, 3 1/2" combination pressure & temperature gauge, M&M 750 low water cut-off control with manual reset.

BURNER: UL listed with pre-piped, wired and factory tested forced draft power burners for natural gas, propane (LP) gas, No. 2 (diesel) oil, or combination gas/oil.

LPE SERIES

THREE PASS FIRETUBE COMPACT BOILERS

HURST "PERFORMANCE" BOILERS

- Factory Assembled, Prewired and Tested
- No Field Assembly Required
- UL Listed Boiler/Burner Packages
- Fully Assembled, Pre-piped, Prewired, Pressure Tested Gas Trains
- Complies with ASME, UL, CSD-1 and ASHRAE Standards
- High Efficiency, Low Stack Temperatures
- Customer Service Support Through National Network of Sales, Service, Start-up Training and Parts by Factory Representatives

LPE BOILER FEATURES

Modified Scotch designed to fit through a standard 36" x 80" door opening
Up to 100HP (3,348 mbh output).
The Hurst LPE "Performance" boiler is America's most heavily designed and built boiler in its class. Consider the features and specify the Hurst LPE.

1. A welded steel firetube boiler, the LPE has extra-heavy 12-gauge tubes for extended life. All tubes are attached to the tube sheets by rolling and flaring. There are no welded tubes in the LPE.

2. Thickest materials used in the industry . . .

   A. Boiler shell is 5/16" thick boiler plate 20-40 HP / 3/8" 50-100 HP.
   B. Twin boiler tube sheets are 1/2" thick boiler plate.
   C. Insulation is 2" mineral wool and is lagged with 22-gauge boiler jacket.
   D. Extra heavy 4" channel iron boiler skids.

3. Designed to last with special industrial grade features . . .

   A. Couplings are 3,000 psi.
   B. Flanged, detachable front and rear smoke boxes.
   C. Brass nuts on front access panels, brass plugs in factory pre-piped crosses and tees on trim.

Revised 03/02

hurstboiler.com

P. O. Drawer 530
21971 Highway 319 N.
Coolidge, Georgia 31738
1-877-994-8778 (Toll Free)
(229) 346-3545 (Tel.)
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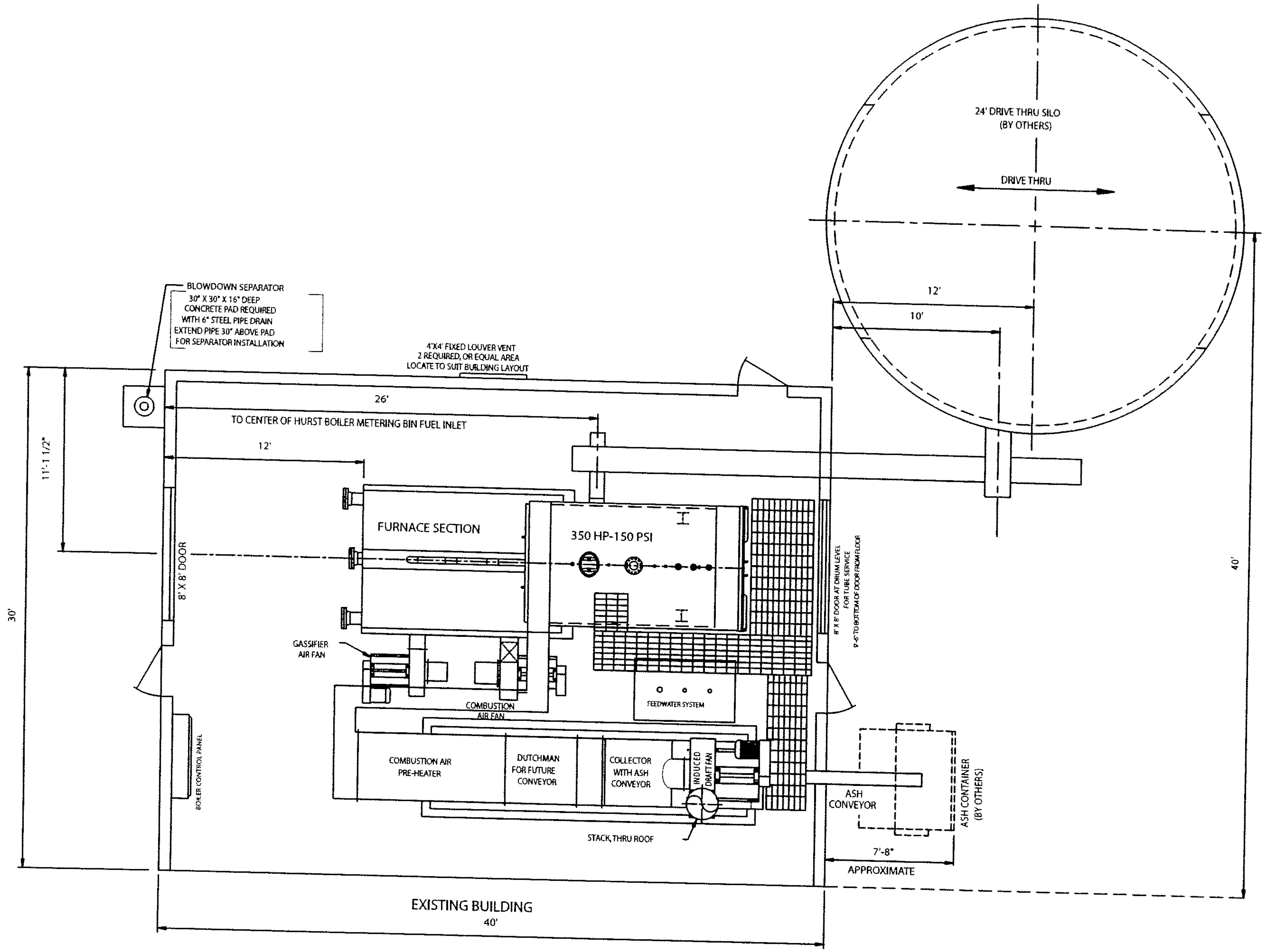
e-mail: info@hurstboiler.com



PLAN VIEW

SFD# 350 HP
Hybrid w/ silo
fuel feed system.

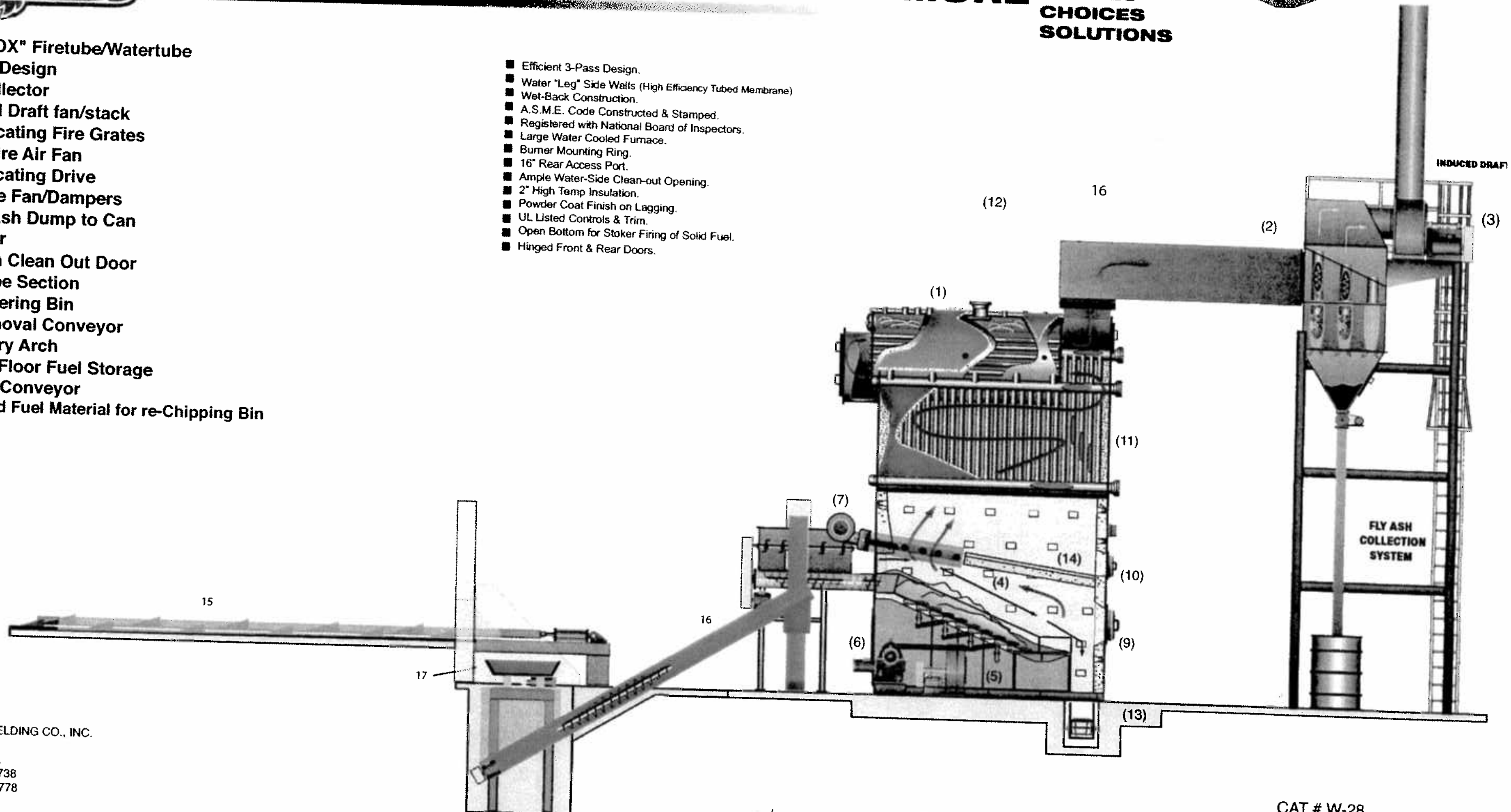
Hurst Boiler & Welding Company, Inc.

Reciprocating Grate
Combustion System

MORE MODELS CHOICES SOLUTIONS

(1) "FIREBOX" Firetube/Watertube Vessel Design
(2) Ash Collector
(3) Induced Draft fan/stack
(4) Reciprocating Fire Grates
(5) Under Fire Air Fan
(6) Reciprocating Drive
(7) Over Fire Fan/Dampers
(8) Rotary Ash Dump to Can
(9) Fire Door
(10) Aux. Ash Clean Out Door
(11) Watertube Section
(12) Fuel Metering Bin
(13) Ash Removal Conveyor
(14) Refractory Arch
(15) Walking Floor Fuel Storage
(16) Transfer Conveyor
(17) Over Sized Fuel Material for re-Chipping Bin

- Efficient 3-Pass Design.
- Water "Leg" Side Walls (High Efficiency Tubed Membrane)
- Wet-Back Construction.
- A.S.M.E. Code Constructed & Stamped.
- Registered with National Board of Inspectors.
- Large Water Cooled Furnace.
- Burner Mounting Ring.
- 16" Rear Access Port.
- Ample Water-Side Clean-out Opening.
- 2" High Temp Insulation.
- Powder Coat Finish on Lagging.
- UL Listed Controls & Trim.
- Open Bottom for Stoker Firing of Solid Fuel.
- Hinged Front & Rear Doors.



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Fax.(229) 346-3874
Email: info@hurstboiler.com

CAT # W-28

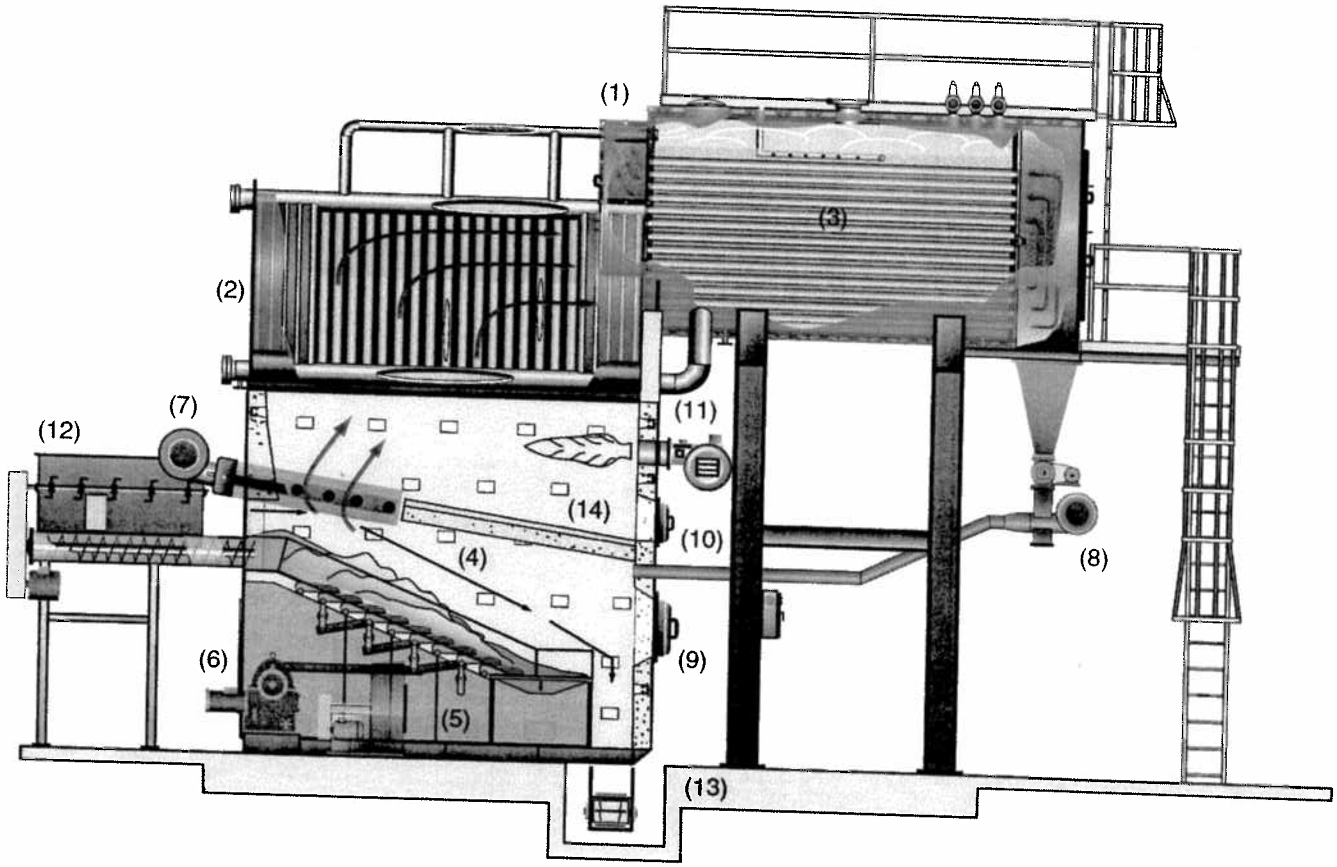
HURST N65 FIREBOX RG

Reciprocating Grate System Modular Packaged

Reciprocating Grate
Combustion System

HURST The Solid Fuel People

(1) Hybrid" Firetube/Watertube Vessel Design
(2) Watertube Section
(3) Firetube Section
(4) Reciprocating Fire Grates
(5) Under Fire Air Fan
(6) Reciprocating Drive
(7) Over Fire Fan/Dampers
(8) Carry-Over Reinjection Blower
(9) Fire Door
(10) Ash Clean Out Door
(11) Optional Back Up Burner
(12) Fuel Metering Bin
(13) Ash Removal Conveyor
(14) Refractory Arch



The Hybrid RG design is suitable for applications to produce high pressure steam or hot water in ranges from 3,450 – 60,000 lbs/hr (3.4 mmBTU – 60 mmBTU) output from 100 up to 400 PSI. This system is designed by HBC to combine the best technologies from the "old school" of biomass combustion and the latest advanced combustion control technologies. The new HBC reciprocating grate-type stoker system permits biomass fuels with a high proportion of incombustibles to be combusted in an efficient manner with the added advantage of automatic de-ashing. This combination is particularly suitable for heating applications in lumber dry kilns, veneer log vats, veneer dryers, greenhouses, factories, schools and office buildings. This combination enables these systems to provide a flexible and reliable operation utilizing a consistent "grade" of biomass waste with moisture contents ranging from 30 – 50%. The boiler vessel is a two pass hybrid design incorporating a water tubed boiler-type water membrane and a two-pass fire tube scotch marine vessel. This vessel's advantages over standard water tube boilers include much larger steam disengagement area providing high quality steam, larger steam storage capability for quicker response to sudden steam demand and much larger thermal storage that provides fast demand response times and safer operation.

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CAT # W-02

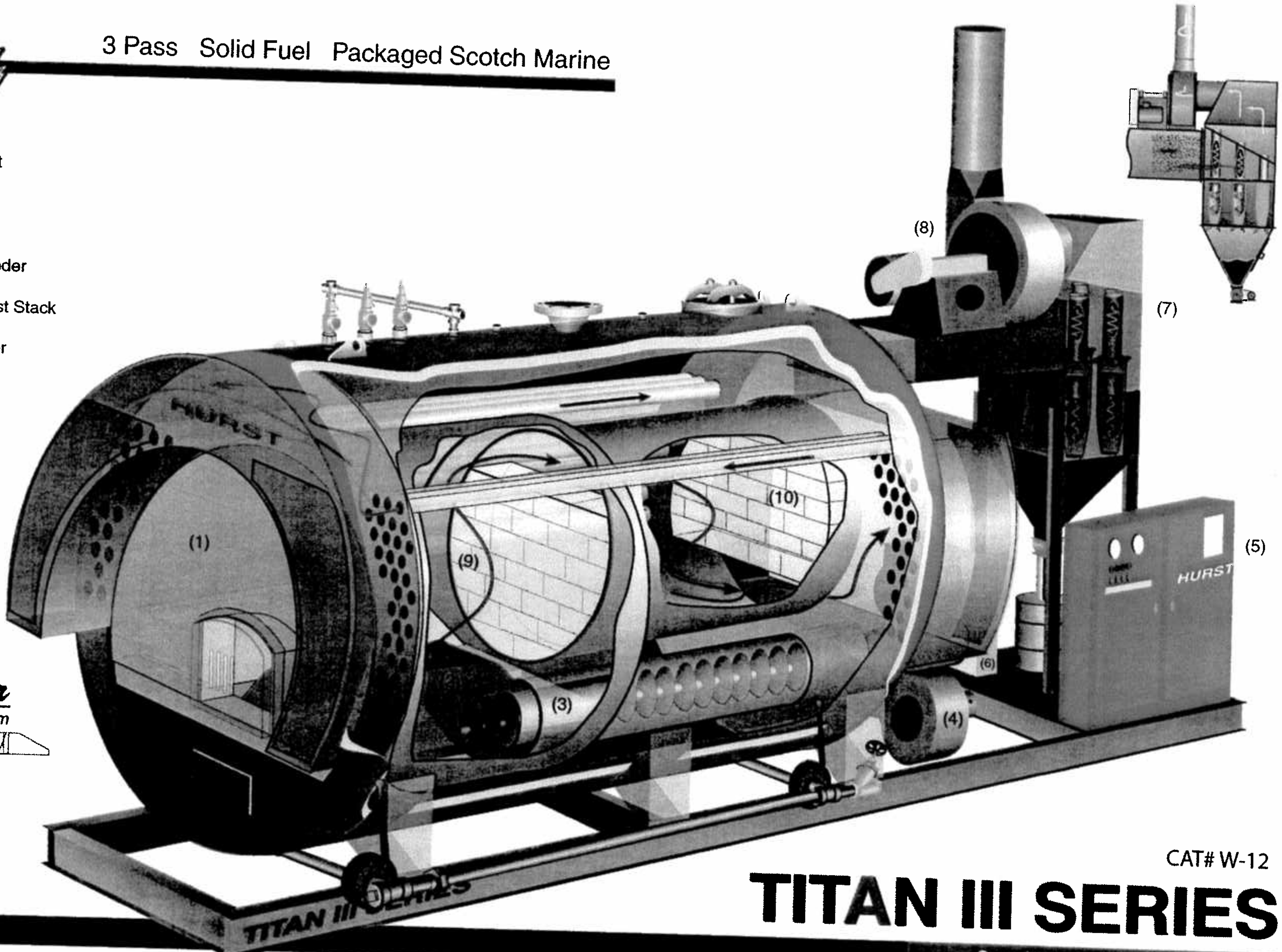
HURST HYBRID RG

Reciprocating Grate System **Modular Packaged**

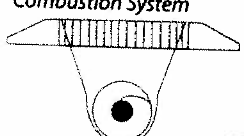
Hurst Boiler & Welding Company, Inc.

3 Pass Solid Fuel Packaged Scotch Marine

(1) Fire Door / Ash Clean Out
(2) Under Fire Fuel Stoker
(3) Fuel Feed Screw
(4) Under Fire Air Fan
(5) Control Panel
(6) Rotary Air Lock / Fuel Feeder
(7) Emissions Ash Collector
(8) Induced Daft Fan / Exhaust Stack
(9) Combustion Furnace
(10) Thermal Release Chamber



Under Feed Stoker
Combustion System



CAT# W-12

TITAN III SERIES

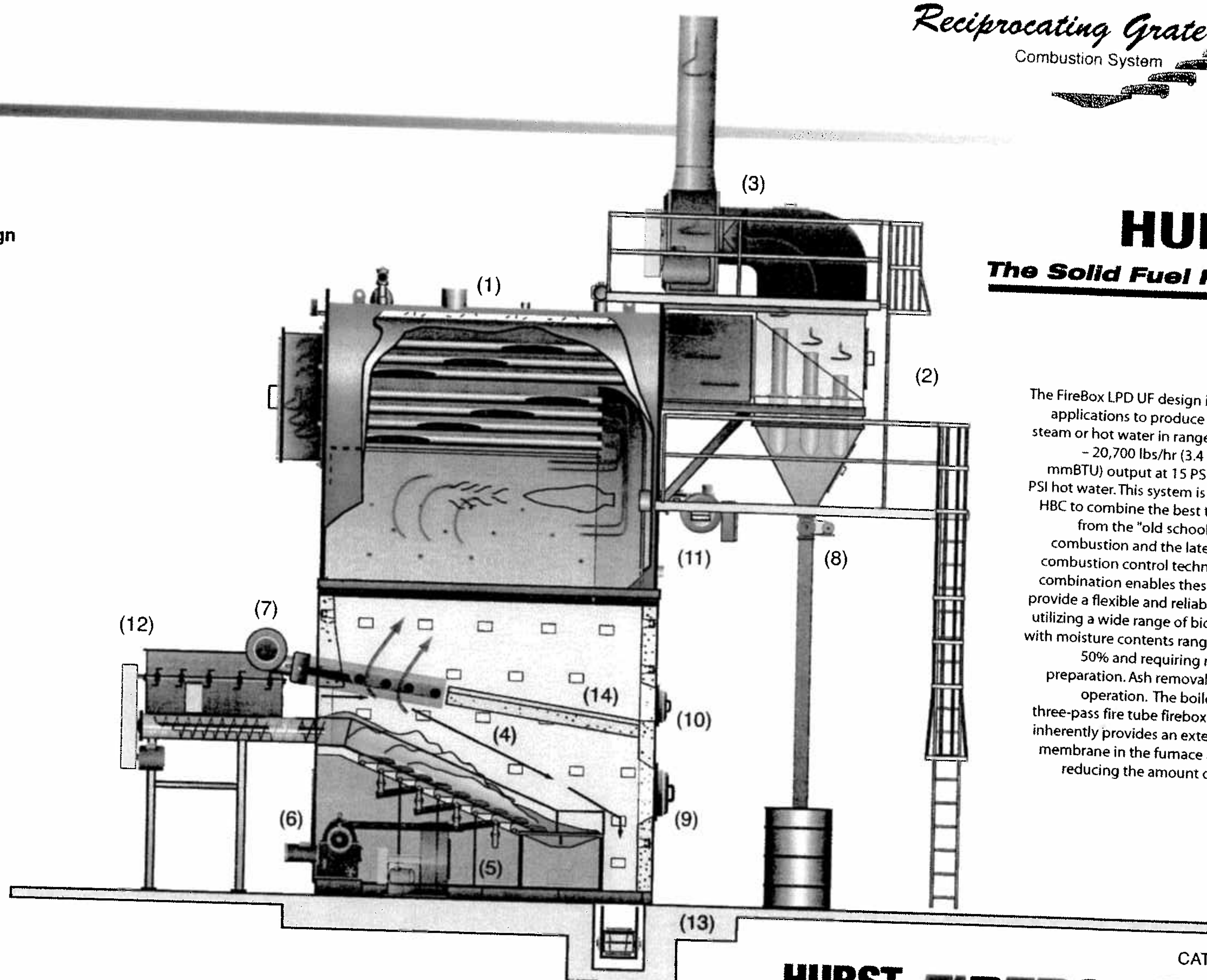
Completely Packaged Skid System

The Solid Fuel People

Reciprocating Grate
Combustion System

HURST
The Solid Fuel People

(1) "FIREBOX" Firetube Vessel Design
(2) Ash Collector
(3) Induced Draft fan/stack
(4) Reciprocating Fire Grates
(5) Under Fire Air Fan
(6) Reciprocating Drive
(7) Over Fire Fan/Dampers
(8) Rotary Ash Dump to Can
(9) Fire Door
(10) Aux. Ash Clean Out Door
(11) Optional Back Up Burner
(12) Fuel Metering Bin
(13) Ash Removal Conveyor
(14) Refractory Arch



The FireBox LPD UF design is suitable for applications to produce low pressure steam or hot water in ranges from 3,450 – 20,700 lbs/hr (3.4 mmBTU – 20 mmBTU) output at 15 PSI steam or 30 PSI hot water. This system is designed by HBC to combine the best technologies from the "old school" of biomass combustion and the latest advanced combustion control technologies. This combination enables these systems to provide a flexible and reliable operation utilizing a wide range of biomass waste with moisture contents ranging from 8 – 50% and requiring minimal fuel preparation. Ash removal is a manual operation. The boiler vessel is a three-pass fire tube firebox design that inherently provides an extended water membrane in the furnace area greatly reducing the amount of refractory required.

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CAT # W-22

HURST FIREBOX RG

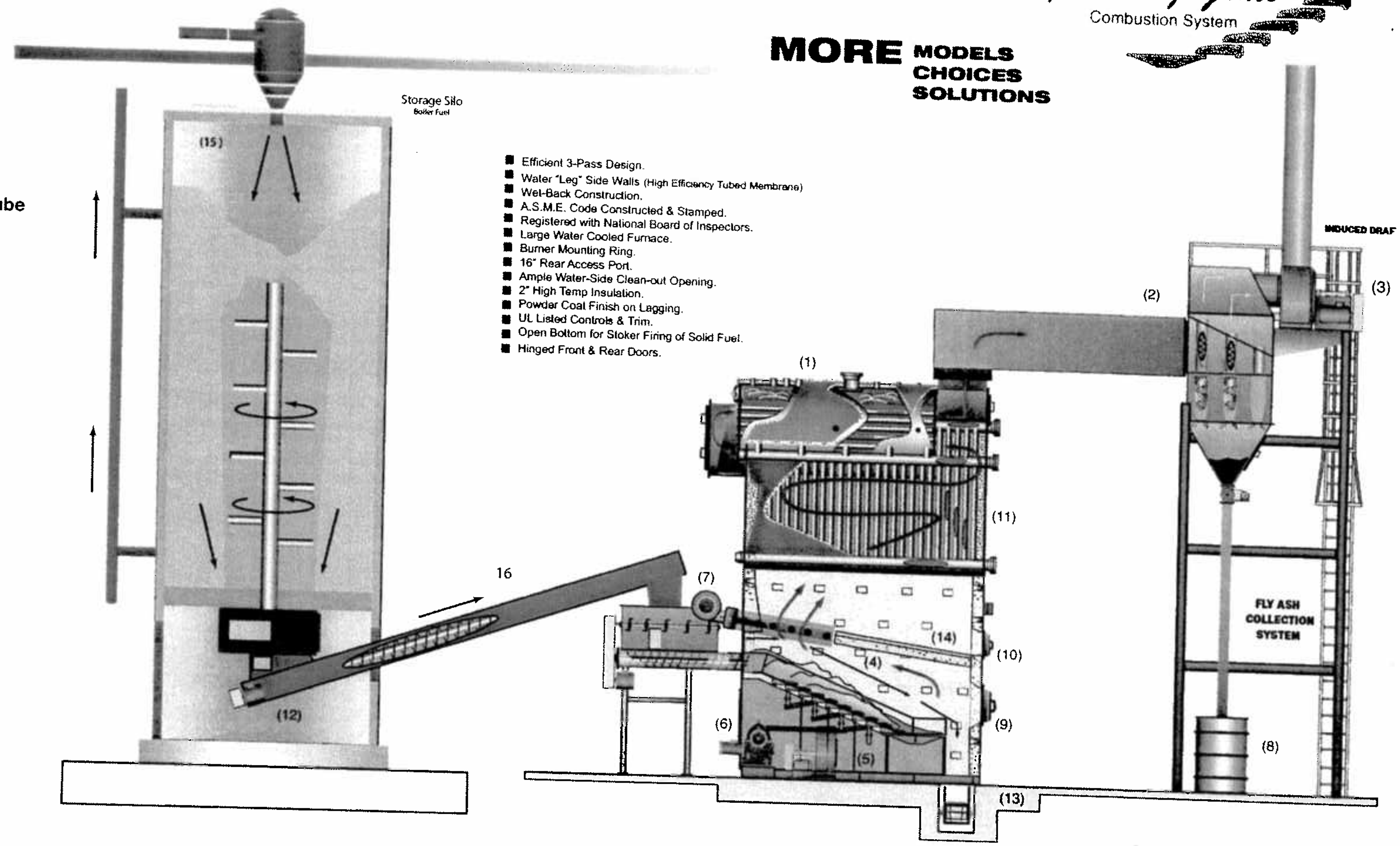
Reciprocating Grate System Modular Packaged

Reciprocating Grate

Combustion System

MORE MODELS CHOICES SOLUTIONS

(1) "FIREBOX" Firetube/Watertube Vessel Design
(2) Ash Collector
(3) Induced Draft fan/stack
(4) Reciprocating Fire Grates
(5) Under Fire Air Fan
(6) Reciprocating Drive
(7) Over Fire Fan/Dampers
(8) Rotary Ash Dump to Can
(9) Fire Door
(10) Aux. Ash Clean Out Door
(11) Watertube Section
(12) Fuel Metering Bin
(13) Ash Removal Conveyor
(14) Refractory Arch
(15) Silo Fuel Storage
(16) Transfer Conveyor



- Efficient 3-Pass Design.
- Water "Leg" Side Walls (High Efficiency Tubed Membrane)
- Wet-Back Construction.
- A.S.M.E. Code Constructed & Stamped.
- Registered with National Board of Inspectors.
- Large Water Cooled Furnace.
- Burner Mounting Ring.
- 16" Rear Access Port.
- Ample Water-Side Clean-out Opening.
- 2" High Temp Insulation.
- Powder Coat Finish on Lagging.
- UL Listed Controls & Trim.
- Open Bottom for Stoker Firing of Solid Fuel.
- Hinged Front & Rear Doors.

150
250
300
450
PSI
High Pressure Design

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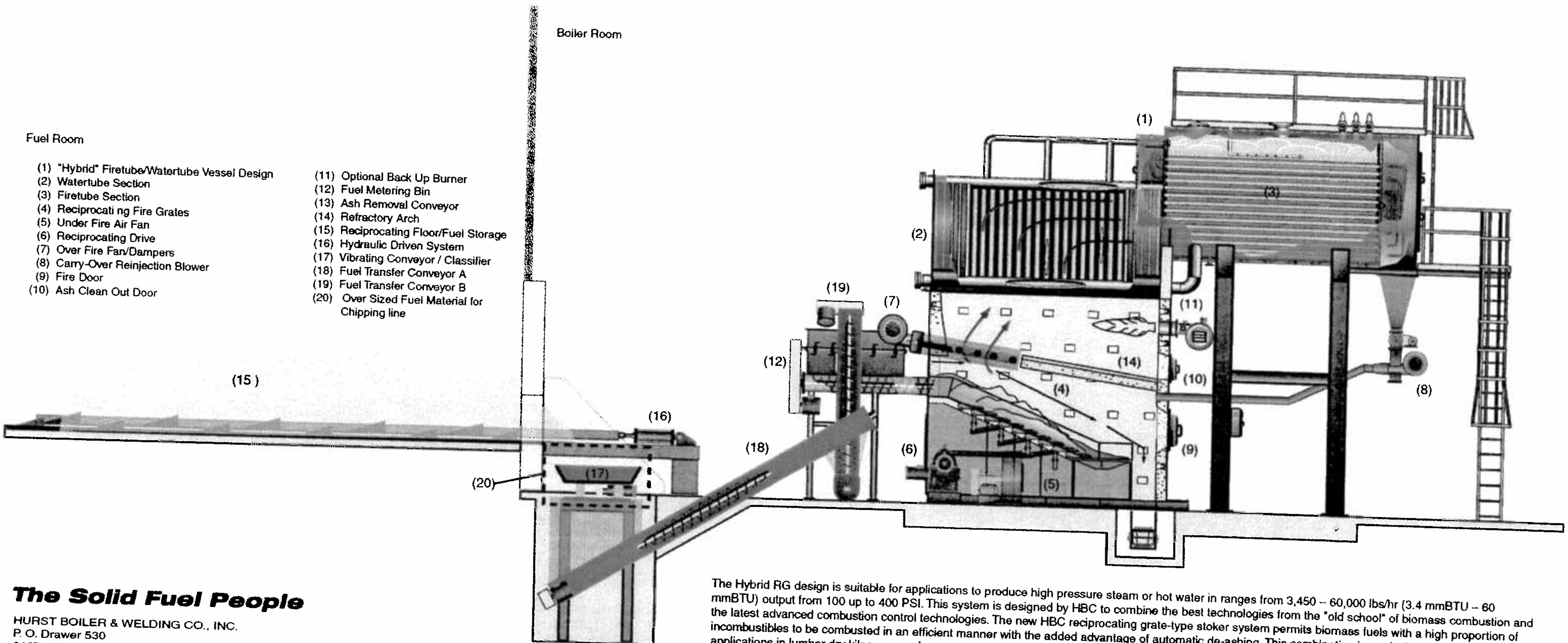
CAT # W-27

HURST N65 FIREBOX RG

Reciprocating Grate System **Modular Packaged**

Reciprocating Grate
Combustion System

HURST



(1) "Hybrid" Firetube/Watertube Vessel Design
(2) Watertube Section
(3) Firetube Section
(4) Reciprocati ng Fire Grates
(5) Under Fire Air Fan
(6) Reciprocating Drive
(7) Over Fire Fan/Dampers
(8) Carry-Over Reinjection Blower
(9) Fire Door
(10) Ash Clean Out Door
(11) Optional Back Up Burner
(12) Fuel Metering Bin
(13) Ash Removal Conveyor
(14) Refractory Arch
(15) Reciprocating Floor/Fuel Storage
(16) Hydraulic Driven System
(17) Vibrating Conveyor / Classifier
(18) Fuel Transfer Conveyor A
(19) Fuel Transfer Conveyor B
(20) Over Sized Fuel Material for Chipping line

The Solid Fuel People

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Email: info@hurstboiler.com

The Hybrid RG design is suitable for applications to produce high pressure steam or hot water in ranges from 3,450 – 60,000 lbs/hr (3.4 mmBTU – 60 mmBTU) output from 100 up to 400 PSI. This system is designed by HBC to combine the best technologies from the "old school" of biomass combustion and the latest advanced combustion control technologies. The new HBC reciprocating grate-type stoker system permits biomass fuels with a high proportion of incombustibles to be combusted in an efficient manner with the added advantage of automatic de-ashing. This combination is particularly suitable for heating applications in lumber dry kilns, veneer log vats, veneer dryers, greenhouses, factories, schools and office buildings. This combination enables these systems to provide a flexible and reliable operation utilizing a consistent "grade" of biomass waste with moisture contents ranging from 30 – 50%. The boiler vessel is a two pass hybrid design incorporating a water tubed boiler-type water membrane and a two-pass fire tube scotch marine vessel. This vessel's advantages over standard water tube boilers include much larger steam disengagement area providing high quality steam, larger steam storage capability for quicker response to sudden steam demand and much larger thermal storage that provides fast demand response times and safer operation.

CAT # W-08 **HYBRID RG**

Reciprocating Grate System **Modular Packaged**

Solid Fuel Solutions

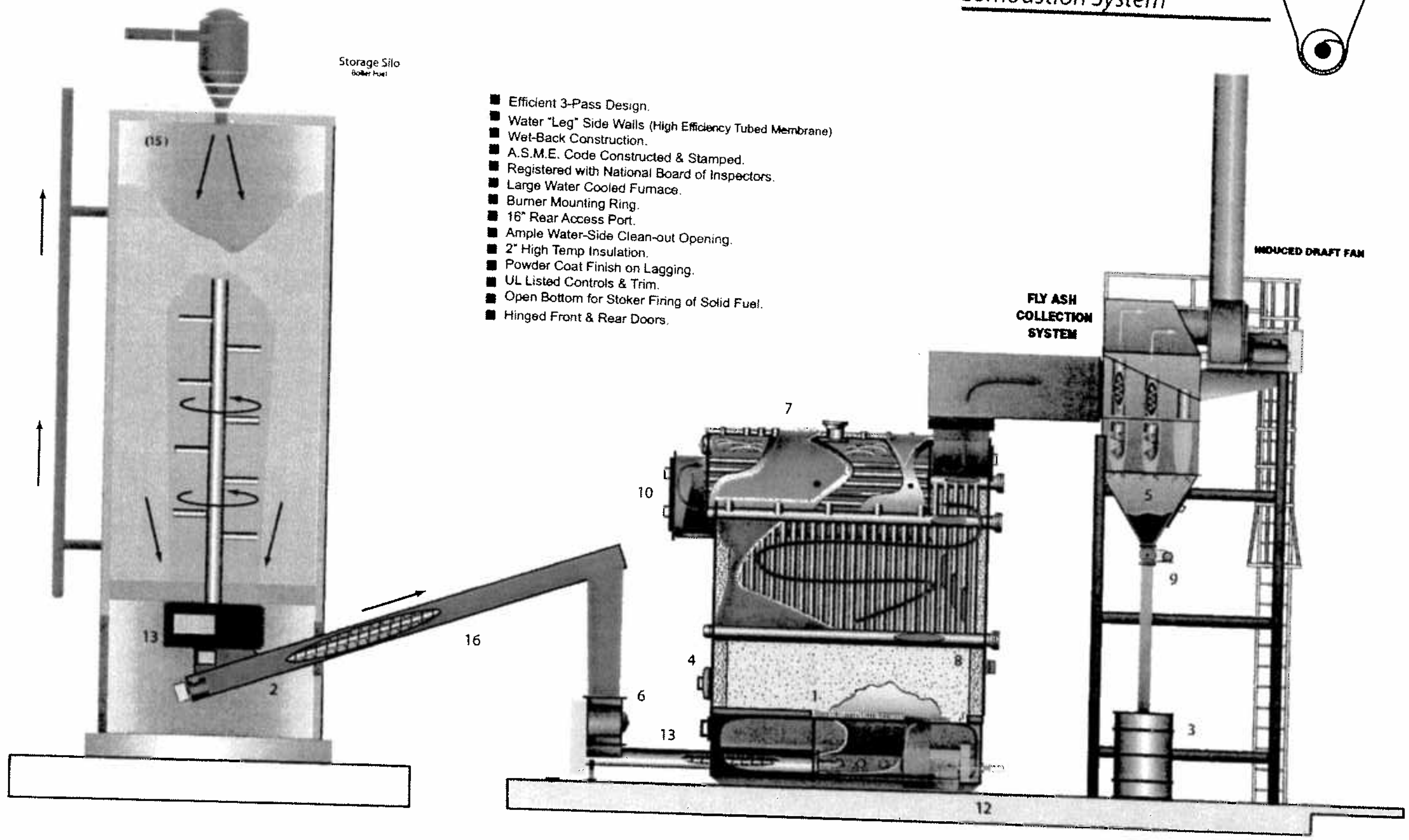
MORE MODELS CHOICES SOLUTIONS

Under Feed Stoker
Combustion System

(1) Cast Alloy Under Fire Stoker
(2) Fuel Metering Bin
(3) Ash Collection Can
(4) Fire Door/Clean-Out
(5) Fly-Ash Collection System
(6) Rotary Air Lock Fuel Feeder
(7) 3-pass Firetube / Watertube Boiler
(8) Packaged Combustion Chamber
(9) Rotary Air Lock/Fly-Ash Dump

(10) Tube Cleaning Acess
(11) Induce Draft Fan
(12) Under Fire Air fan
(13) Silo unloader
(14) Fuel feed screw
(15) Fuel storage Silo
(16) Fuel Transfer Conveyor
(17)

- Efficient 3-Pass Design.
- Water "Leg" Side Walls (High Efficiency Tubed Membrane)
- Wet-Back Construction.
- A.S.M.E. Code Constructed & Stamped.
- Registered with National Board of Inspectors.
- Large Water Cooled Furnace.
- Burner Mounting Ring.
- 16" Rear Access Port.
- Ample Water-Side Clean-out Opening.
- 2" High Temp Insulation.
- Powder Coat Finish on Lagging.
- UL Listed Controls & Trim.
- Open Bottom for Stoker Firing of Solid Fuel.
- Hinged Front & Rear Doors.



150 250 300 450 PSI High Pressure Design

The Solid Fuel People

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The N65 FireBox HPD UF design is suitable for applications to produce high pressure steam. The boiler vessel is a three-pass firetube / firebox design that inherently provides an extended water membrane in the furnace area greatly reducing the amount of refractory required.

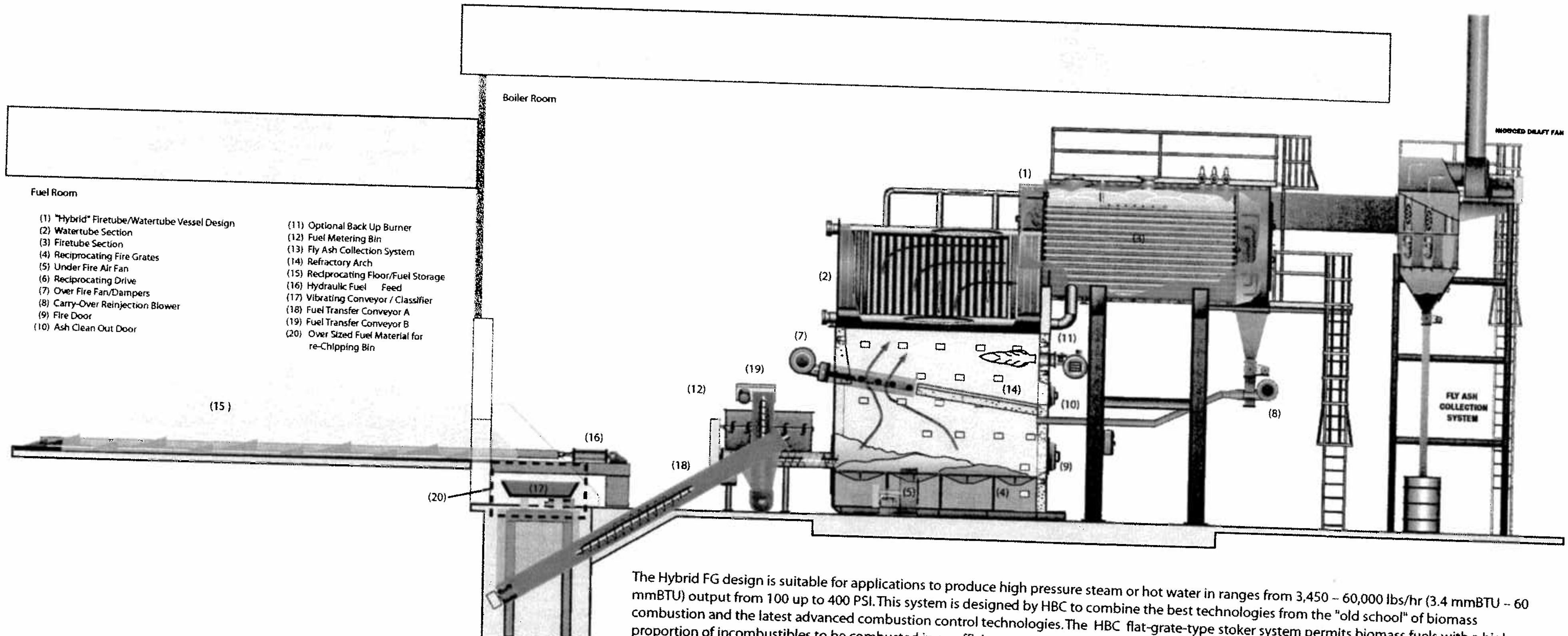
CAT# W-26

HURST N65 FIREBOX HPD UF

Modular Packaged

Under Fire Feed System

HURST



The Hybrid FG design is suitable for applications to produce high pressure steam or hot water in ranges from 3,450 – 60,000 lbs/hr (3.4 mmBTU – 60 mmBTU) output from 100 up to 400 PSI. This system is designed by HBC to combine the best technologies from the "old school" of biomass combustion and the latest advanced combustion control technologies. The HBC flat-grate-type stoker system permits biomass fuels with a high proportion of incombustibles to be combusted in an efficient manner. This combination is particularly suitable for heating applications in lumber dry kilns, veneer log vats, veneer dryers, greenhouses, factories, schools and office buildings. This combination enables these systems to provide a flexible and reliable operation utilizing a consistent burning of biomass waste with moisture contents ranging from 30 – 50%. The boiler vessel is a two pass hybrid design incorporating a water tubed boiler-type water membrane and a two-pass fire tube scotch marine vessel. This vessel's advantages over standard water tube boilers include much larger steam disengagement area providing high quality steam, larger steam storage capability for quicker response to sudden steam demand and much larger thermal storage that provides fast demand response times and safer operation.

The Solid Fuel People

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CAT# W-10

HURST HYBRID FG

Flat Grate System

Modular Packaged

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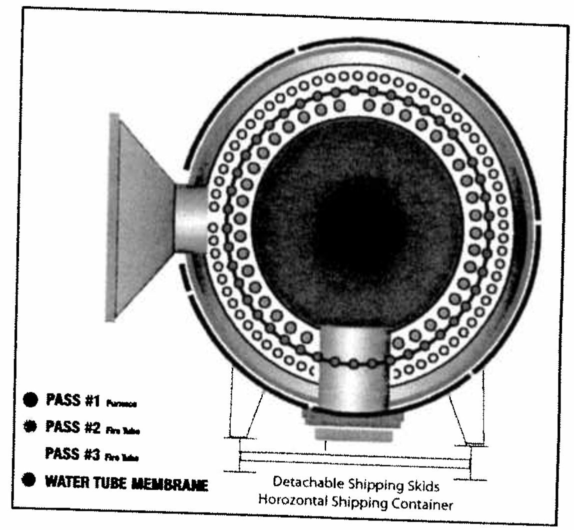
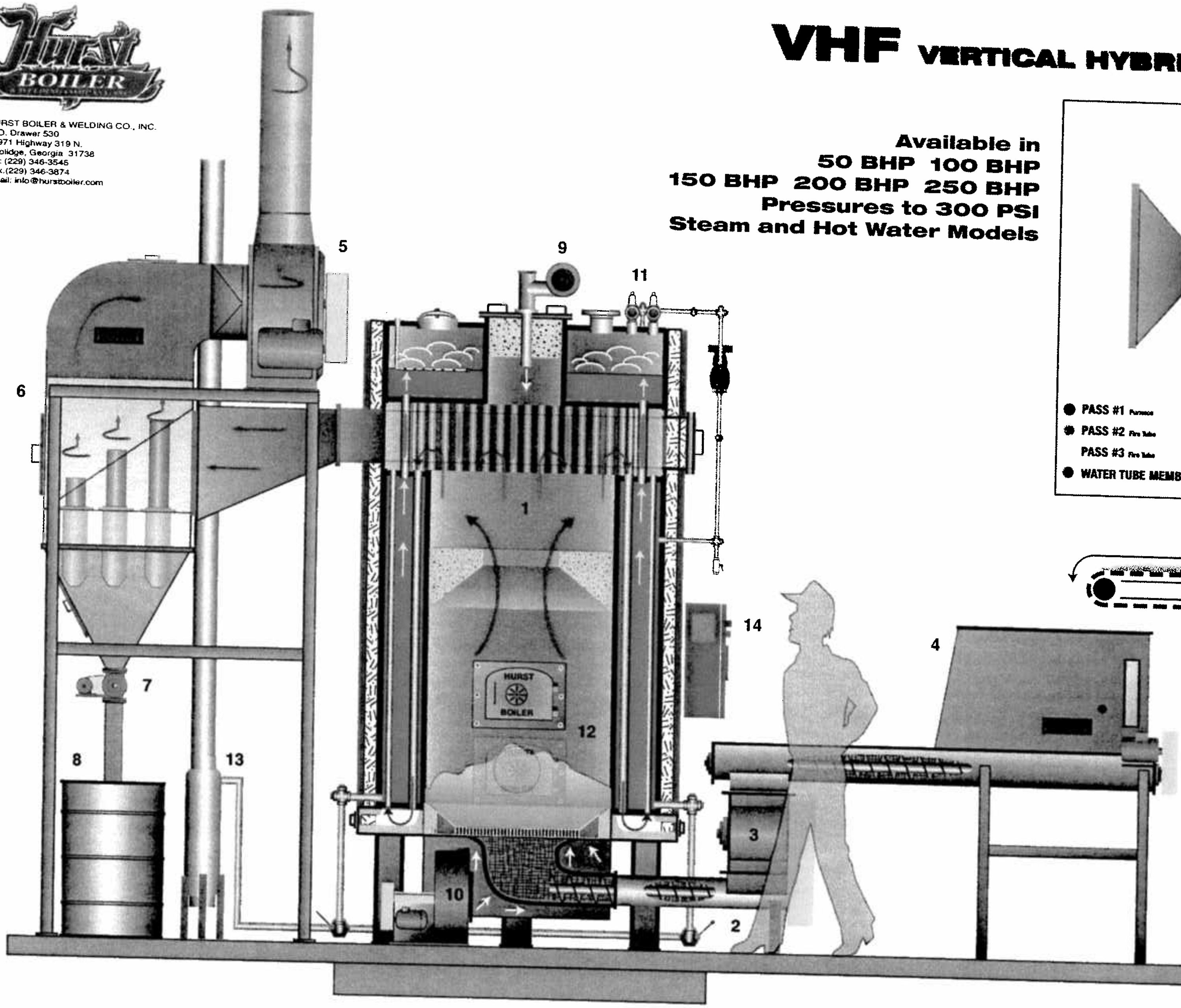
VHF VERTICAL HYBRID FIREBOX SERIES

Available in
50 BHP 100 BHP
150 BHP 200 BHP 250 BHP
Pressures to 300 PSI
Steam and Hot Water Models





1. Vertical Hybrid FireBox Boiler
2. Fuel Stoker
3. FuelFeeder Rotary AirLock
4. Fuel Metering Bin
5. Induced Draft Fan/ Exhaust Stack
6. FlyAsh Collection System
7. Ash Dump Rotary Airlock
8. Ash Collection Can
9. Over Fire Air Blower Fan
10. Under Fire Air Blower Fan
11. Steam Outlet/Safety Trim
12. Fire Doors
13. Blow-Down Piping / Flash Separator
14. Control Panel

CAT # W-19

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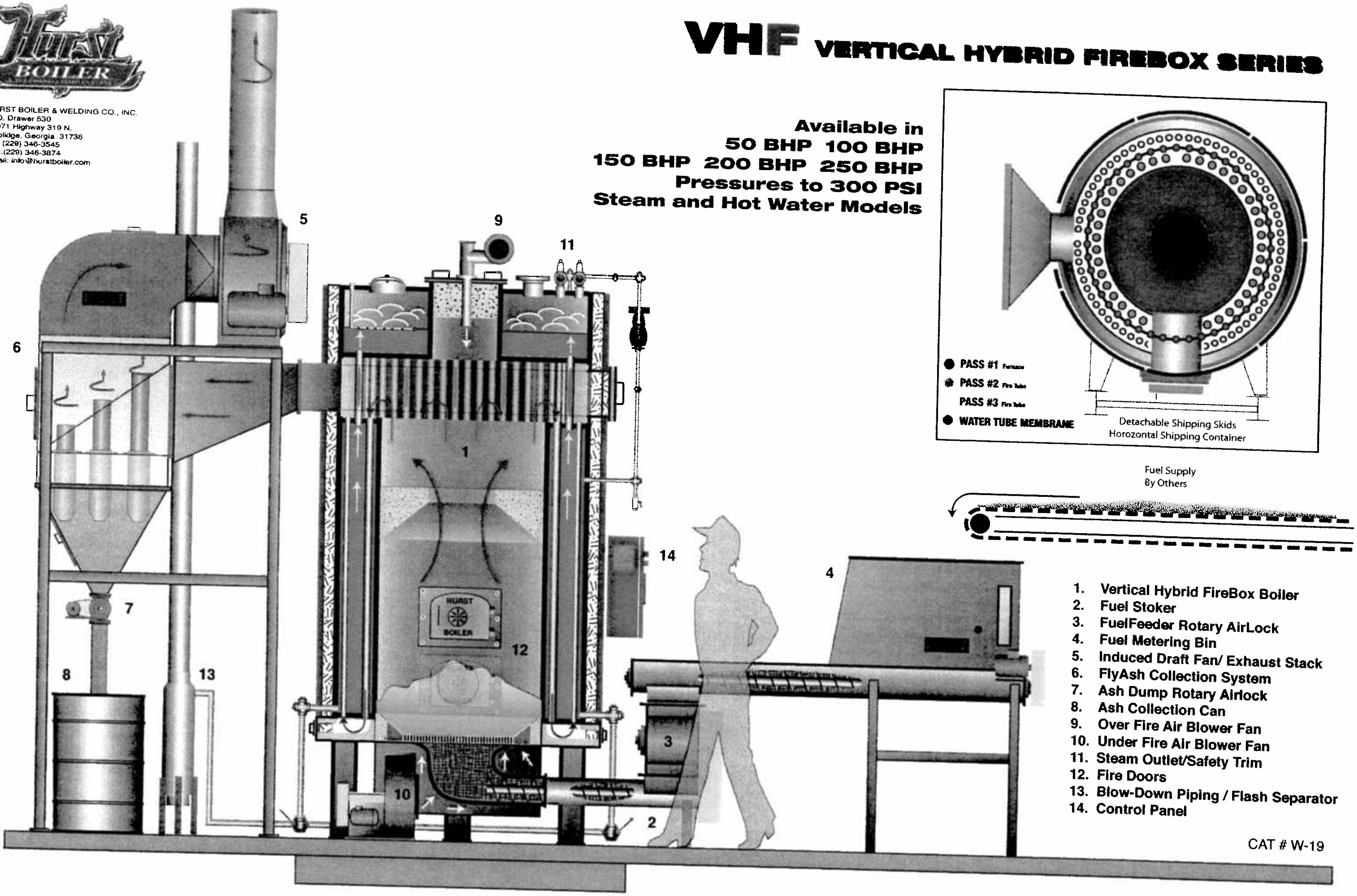
VHF VERTICAL HYBRID FIREBOX SERIES

Available in
50 BHP 100 BHP
150 BHP 200 BHP 250 BHP
Pressures to 300 PSI
Steam and Hot Water Models



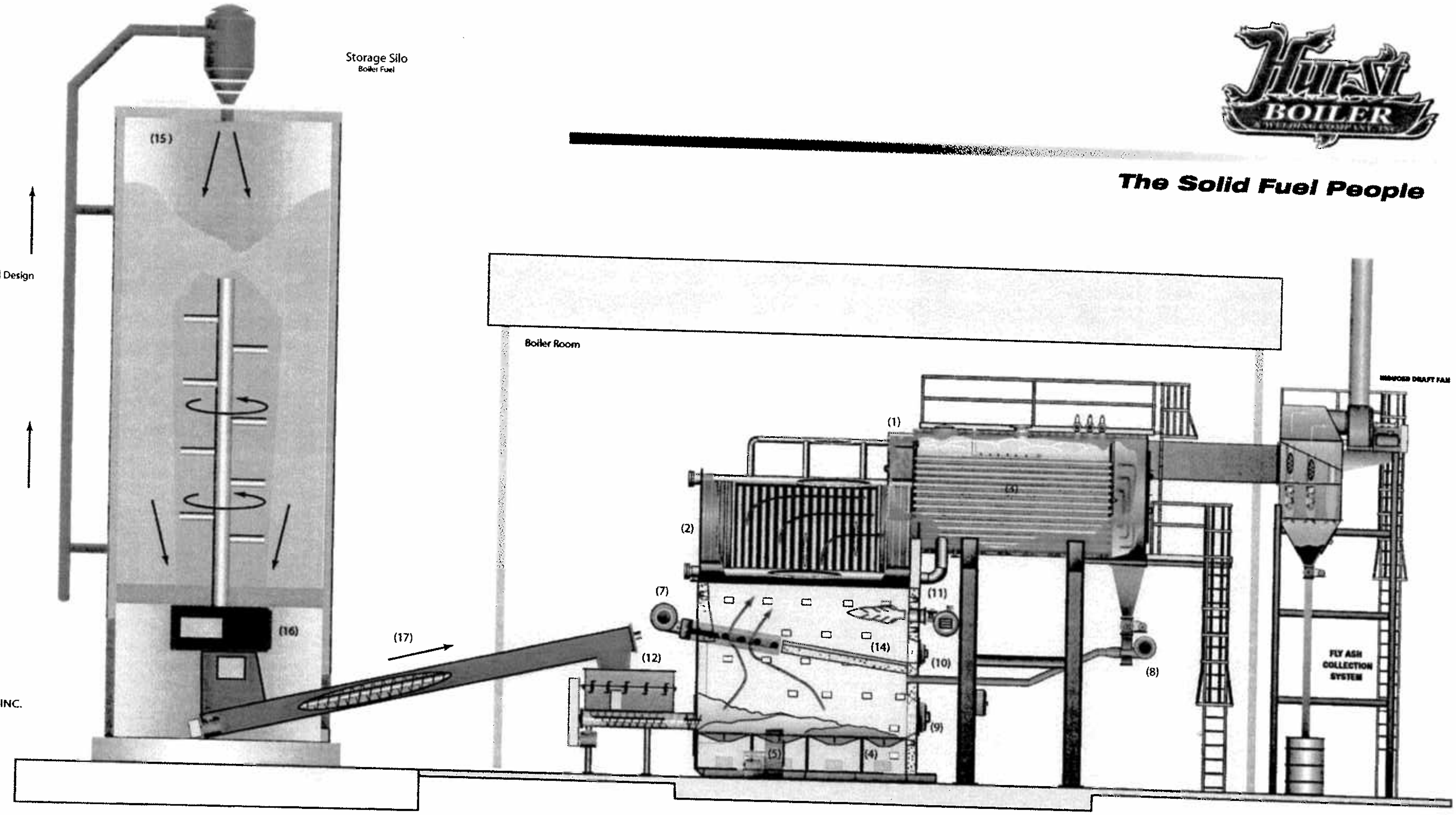
1. Vertical Hybrid FireBox Boiler
2. Fuel Stoker
3. FuelFeeder Rotary AirLock
4. Fuel Metering Bin
5. Induced Draft Fan/ Exhaust Stack
6. FlyAsh Collection System
7. Ash Dump Rotary Airlock
8. Ash Collection Can
9. Over Fire Air Blower Fan
10. Under Fire Air Blower Fan
11. Steam Outlet/Safety Trim
12. Fire Doors
13. Blow-Down Piping / Flash Separator
14. Control Panel

CAT # W-19

The Solid Fuel People

(1) "Hybrid" Firetube/Watertube Vessel Design
(2) Watertube Section
(3) Firetube Section
(4) Reciprocating Fire Grates
(5) Under Fire Air Fan
(6) Reciprocating Drive
(7) Over Fire Fan/Dampers
(8) Carry-Over Reinjection Blower
(9) Fire Door
(10) Ash Clean Out Door

(11) Optional Back Up Burner
(12) Fuel Metering Bin
(13) Fly Ash Collection System
(14) Refractory Arch
(15) Silo Fuel Storage
(16) Automated Fuel Unloader
(17) Fuel Transfer Conveyor



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The Hybrid FG design is suitable for applications to produce high pressure steam or hot water in ranges from 3,450 – 60,000 lbs/hr (3.4 mmBTU – 60 mmBTU) output from 100 up to 400 PSI. This system is designed by HBC to combine the best technologies from the "old school" of biomass combustion and the latest advanced combustion control technologies. The HBC flat-grate-type stoker system permits biomass fuels with a high proportion of incombustibles to be combusted in an efficient manner. This combination is particularly suitable for heating applications in lumber dry kilns, veneer log vats, veneer dryers, greenhouses, factories, schools and office buildings. This combination enables these systems to provide a flexible and reliable operation utilizing a consistent burning of biomass waste with moisture contents ranging from 30 – 50%. The boiler vessel is a two pass hybrid design incorporating a water tubed boiler-type water membrane and a two-pass fire tube scotch marine vessel. This vessel's advantages over standard water tube boilers include much larger steam disengagement area providing high quality steam, larger steam storage capability for quicker response to sudden steam demand and much larger thermal storage that provides fast demand response times and safer operation.

CAT# W-17

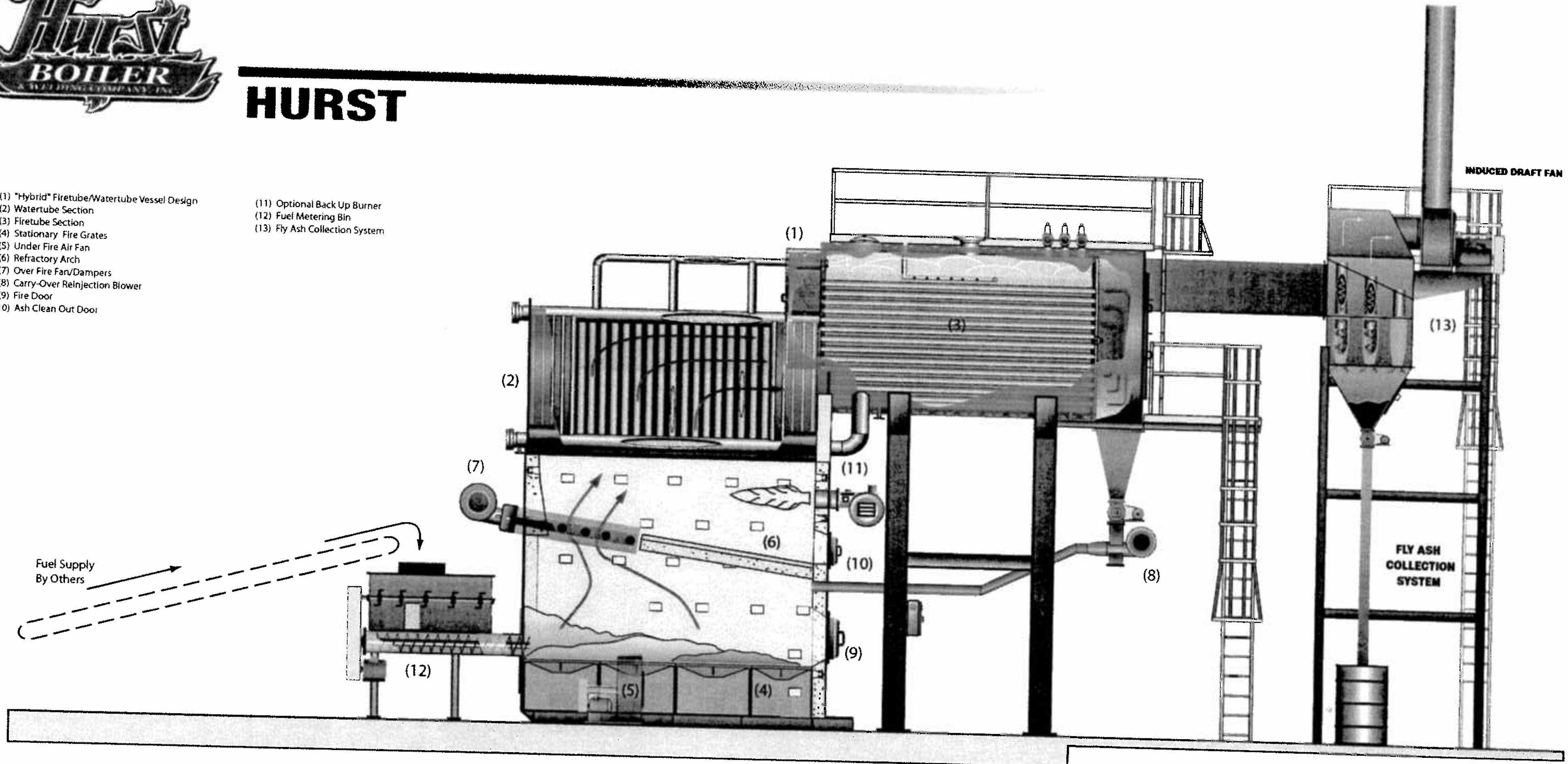
HURST HYBRID FG

Flat Grate System

Modular Packaged

HURST

(1) "Hybrid" Firetube/Watertube Vessel Design
(2) Watertube Section
(3) Firetube Section
(4) Stationary Fire Grates
(5) Under Fire Air Fan
(6) Refractory Arch
(7) Over Fire Fan/Dampers
(8) Carry-Over Reinjection Blower
(9) Fire Door
(10) Ash Clean Out Door
(11) Optional Back Up Burner
(12) Fuel Metering Bin
(13) Fly Ash Collection System



The Solid Fuel People

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CAT# W-15

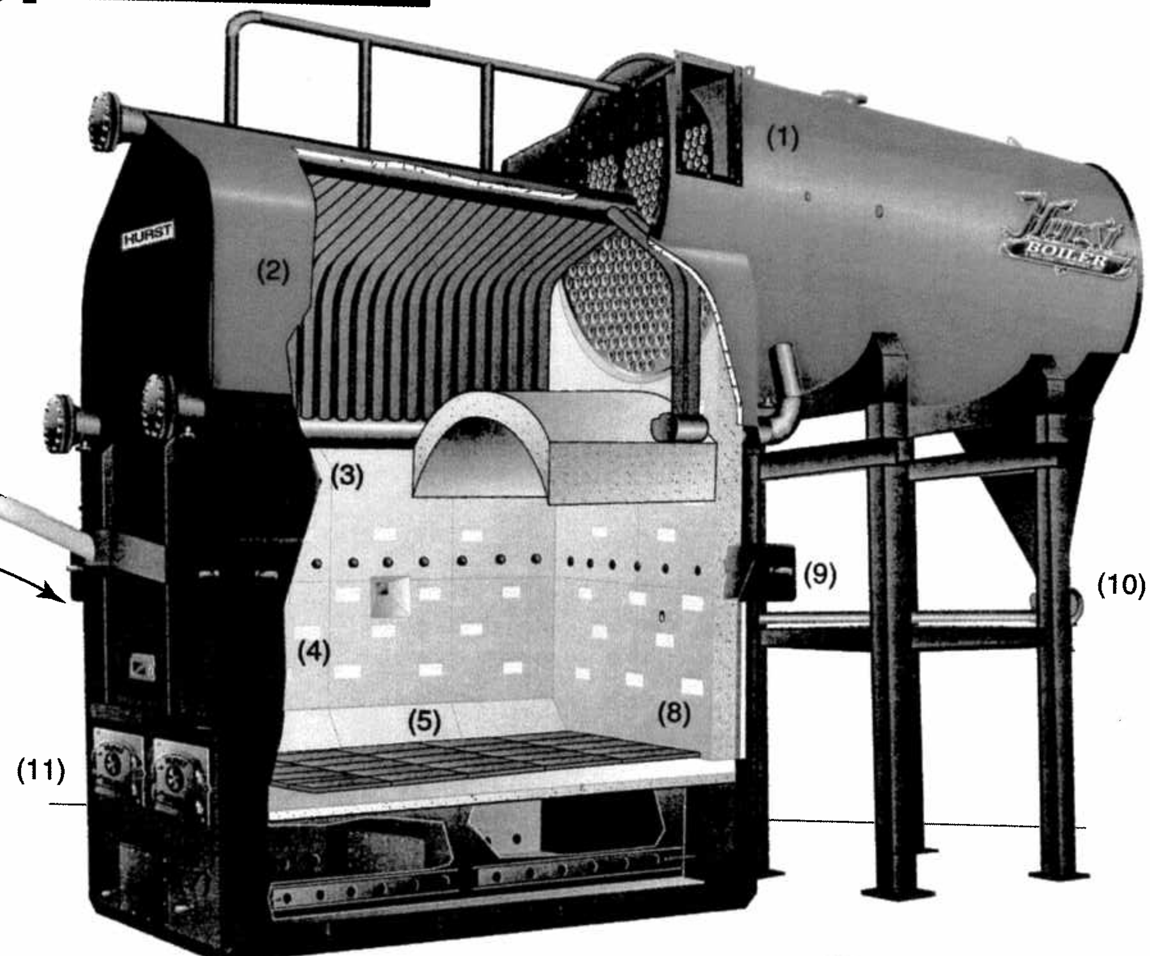
HURST HYBRID FG
Modular Packaged
Flat Grate System

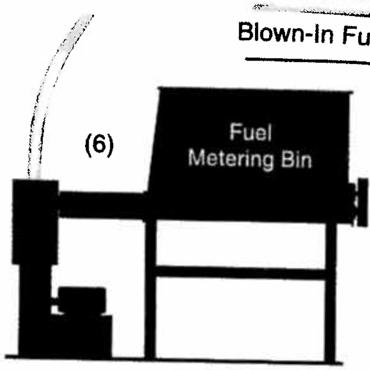
HURST The Solid Fuel People

Pneumatic Fuel Feed

Pneumatic Combustion System

(1) Hybrid Firetube/Watertube Vessel Design
(2) Watertube Section
(3) Radiant Arch
(4) Combustion Chamber
(5) Cast Grates
(6) Pneumatic Fuel feeder
(7) Air Control Dampers
(8) Refractory Lined Furnace
(9) Over Fire Air System
(10) Ash Reinjection Blower
(11) Fire Door





High Velocity
Material Handling/Pneumatic Blower

The Hybrid PF design is suitable for applications to produce high pressure steam or hot water in ranges from 3,450 – 60,000 lbs/hr (3.4 mmBTU – 60 mmBTU) output from 100 up to 400 PSI. This system is designed by HBC to combine the best technologies from the "old school" of biomass combustion and the latest advanced combustion control technologies. HBC's Pneumatic Feed Stoker Systems have proven their ability to provide a very low turn-down rate making it particularly suitable for heating applications in lumber dry kilns, veneer log vats, veneer dryers, greenhouses and factories. This combination enables these systems to provide a flexible and reliable operation utilizing a consistent "grade" of biomass waste with low moisture contents ranging from 8 – 20%. Ash removal is a manual operation. The boiler vessel is a two pass hybrid design incorporating a water tubed boiler-type water membrane and a two-pass fire tube scotch marine vessel. This vessel's advantages over standard water tube boilers include much larger steam disengagement area providing high quality steam, larger steam storage capability for quicker response to sudden steam demand and much larger thermal storage that provides fast demand response times and safer operation.

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CAT# W-06

MULTI DRY FUEL HURST **HYBRID PF**

Hybrid Series *for* Dry Type Fuels Pneumatic Air Feed System **Modular Packaged**

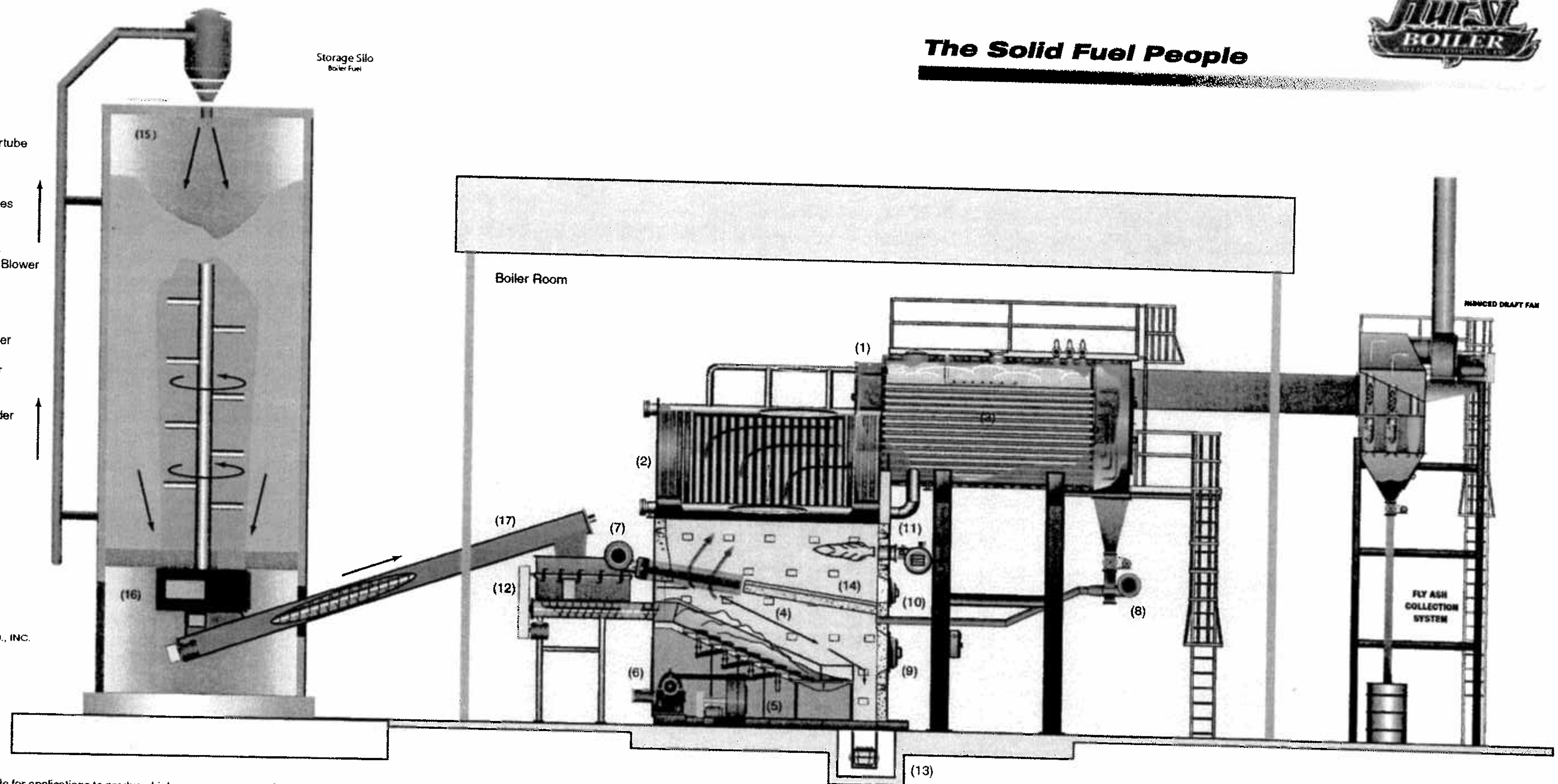
Reciprocating Grate

Combustion System

The Solid Fuel People

(1) "Hybrid" Firetube/Watertube Vessel Design
(2) Watertube Section
(3) Firetube Section
(4) Reciprocating Fire Grates
(5) Under Fire Air Fan
(6) Reciprocating Drive
(7) Over Fire Fan/Dampers
(8) Carry-Over Reinjection Blower
(9) Fire Door
(10) Ash Clean Out Door

(11) Optional Back Up Burner
(12) Fuel Metering Bin
(13) Ash Removal Conveyor
(14) Refractory Arch
(15) Silo Fuel Storage
(16) Automated Fuel Unlaoder
(17) Fuel Transfer Conveyor



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CAT # W-18 **HYBRID RG**

Reciprocating Grate System **Modular Packaged**

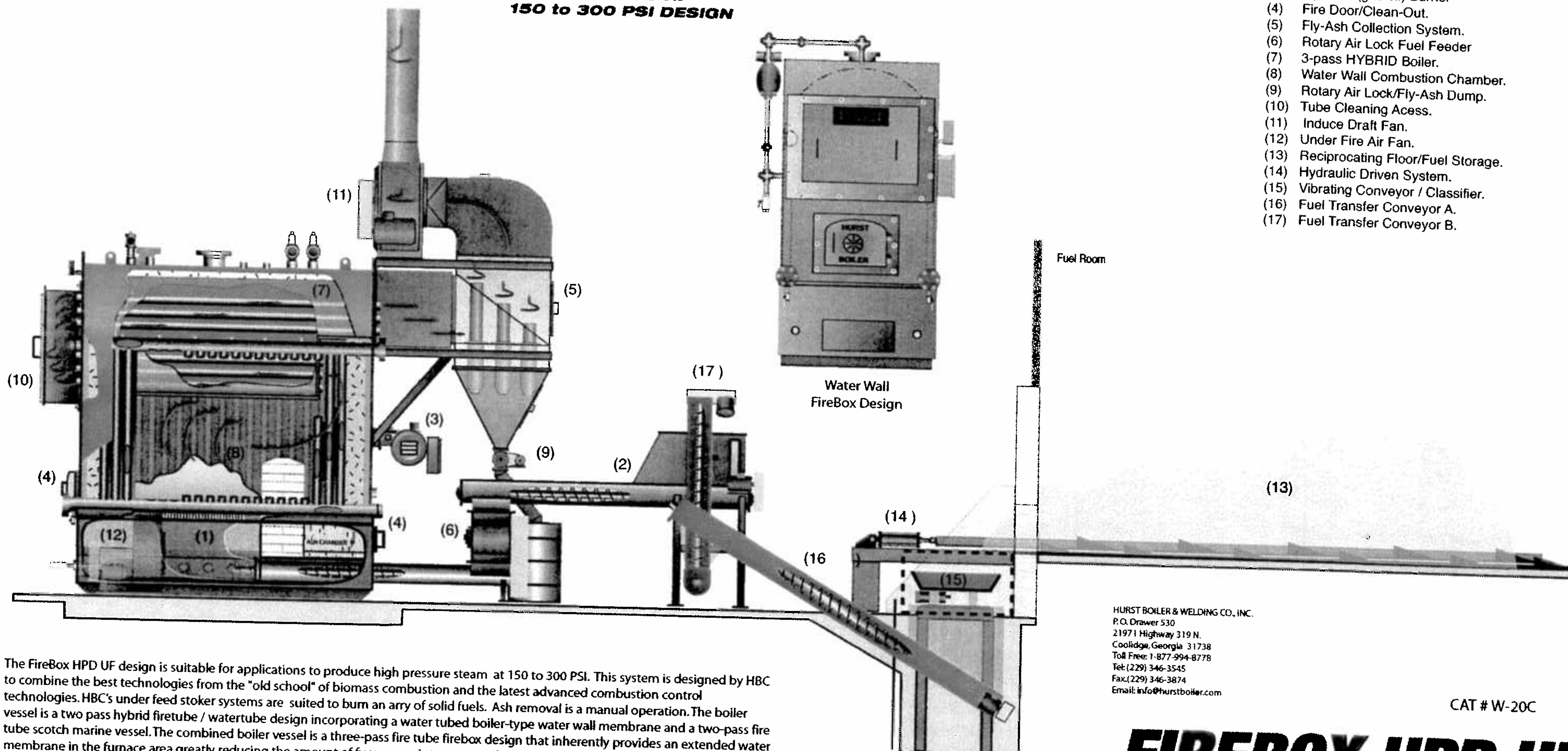
Under Feed Stoker
Combustion System

THREE PASS FIREBOX
HIGH PRESSURE

HURST The Solid Fuel People

CAPACITIES FROM
75 to 1000 HP
150 to 300 PSI DESIGN

(1) Cast Alloy Under Fire Stoker
(2) Fuel Metering Bin.
(3) Optional (gas/oil) Burner
(4) Fire Door/Clean-Out.
(5) Fly-Ash Collection System.
(6) Rotary Air Lock Fuel Feeder
(7) 3-pass HYBRID Boiler.
(8) Water Wall Combustion Chamber.
(9) Rotary Air Lock/Fly-Ash Dump.
(10) Tube Cleaning Acess.
(11) Induce Draft Fan.
(12) Under Fire Air Fan.
(13) Reciprocating Floor/Fuel Storage.
(14) Hydraulic Driven System.
(15) Vibrating Conveyor / Classifier.
(16) Fuel Transfer Conveyor A.
(17) Fuel Transfer Conveyor B.



Water Wall
FireBox Design

The FireBox HPD UF design is suitable for applications to produce high pressure steam at 150 to 300 PSI. This system is designed by HBC to combine the best technologies from the "old school" of biomass combustion and the latest advanced combustion control technologies. HBC's under feed stoker systems are suited to burn an arry of solid fuels. Ash removal is a manual operation. The boiler vessel is a two pass hybrid firetube / watertube design incorporating a water tubed boiler-type water wall membrane and a two-pass fire tube scotch marine vessel. The combined boiler vessel is a three-pass fire tube firebox design that inherently provides an extended water membrane in the furnace area greatly reducing the amount of furnace maintenance and refractory replacement.

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CAT # W-20C

FIREBOX HPD UF

MULTI FUEL

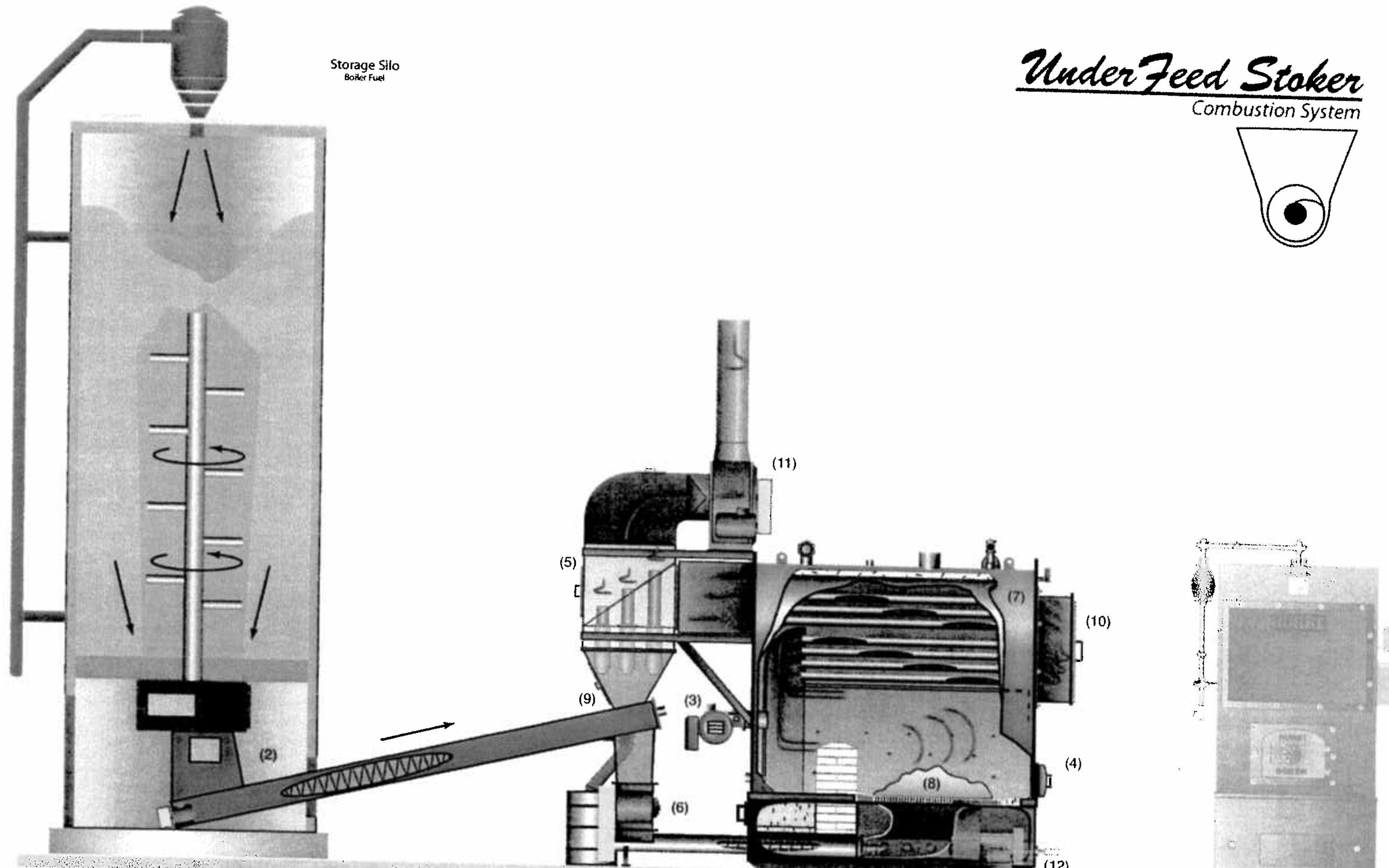
Under Fire Feed System **Modular Packaged**

The Solid Fuel People

Under Feed Stoker

Combustion System

(1) Cast Alloy Under Fire Stoker
(2) Fuel Metering Bin
(3) Optional (Gas/Oil) Burner
(4) Fire Door/Clean-Out
(5) Fly-Ash Collection System
(6) Rotary Air Lock Fuel Feeder
(7) 3-pass Wet Back Boiler
(8) Packaged Combustion Chamber
(9) Rotary Air Lock/Fly-Ash Dump
(10) Tube Cleaning Acess
(11) Induce Draft Fan
(12) Under Fire Air Fan
(13) Fuel Silo (automated unloader)
(14) Fuel Transfer Conveyor



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The FireBox LPD UF design is suitable for applications to produce low pressure steam or hot water in ranges from 3,450 – 20,700 lbs/hr (3.4 mmBTU – 20 mmBTU) output at 15 PSI steam or 30 PSI hot water. This system is designed by HBC to combine the best technologies from the "old school" of biomass combustion and the latest advanced combustion control technologies. HBC's new hand fired systems are particularly suited for operations with extremely low labor cost environments. This combination enables these systems to provide a flexible and reliable operation utilizing a wide range of biomass waste with moisture contents ranging from 8 – 50% and requiring minimal fuel preparation. Ash removal is a manual operation. The boiler vessel is a two pass hybrid design incorporating a water tubed boiler-type water membrane and a two-pass fire tube scotch marine vessel. The boiler vessel is a three-pass fire tube firebox design that inherently provides an extended water membrane in the furnace area greatly reducing the amount of refractory required.

CAT# W-16

FIREBOX LPD UF

Modular Packaged

Under Fire Feed System

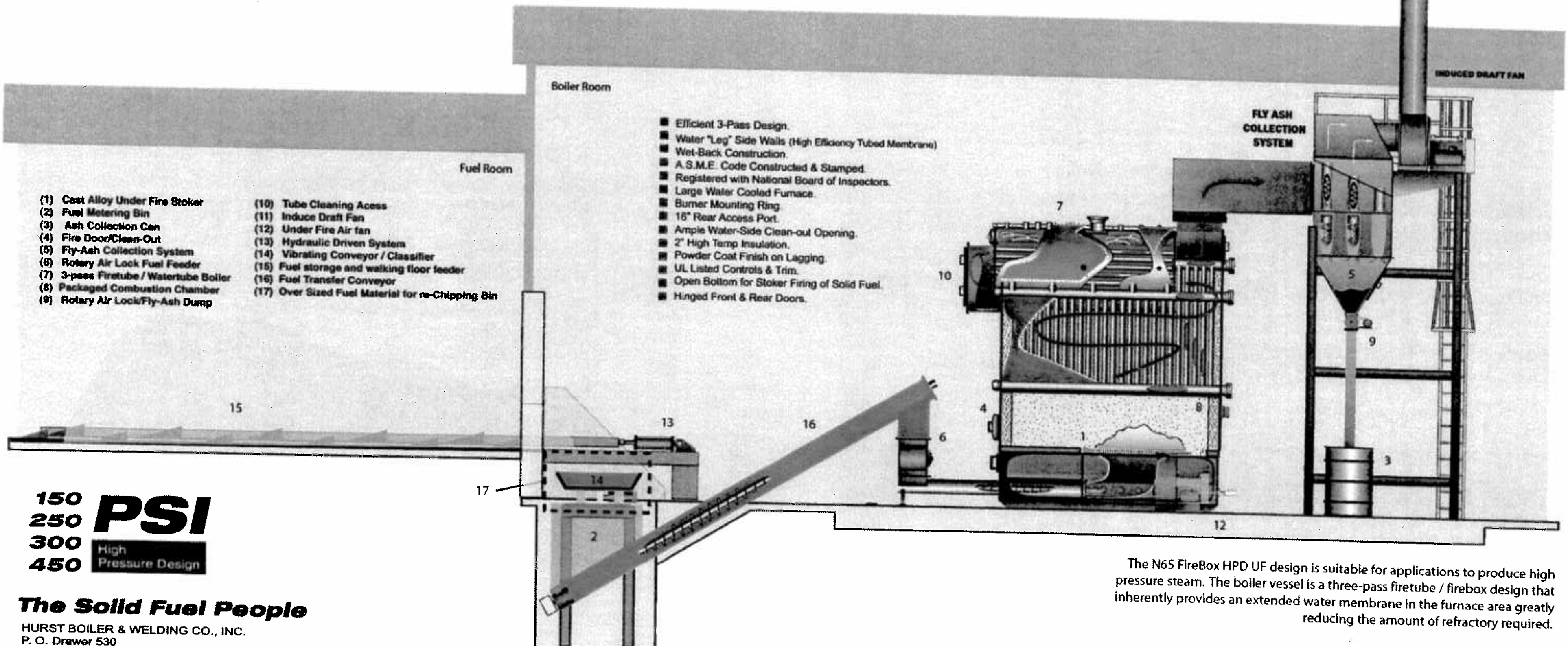
Hurst Boiler & Welding Company, Inc.

Solid Fuel Solutions

MORE MODELS CHOICES SOLUTIONS

Under Feed Stoker

Combustion System



150
250
300
450 **PSI**

High Pressure Design

The N65 FireBox HPD UF design is suitable for applications to produce high pressure steam. The boiler vessel is a three-pass firetube / firebox design that inherently provides an extended water membrane in the furnace area greatly reducing the amount of refractory required.

The Solid Fuel People

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CAT# W-25

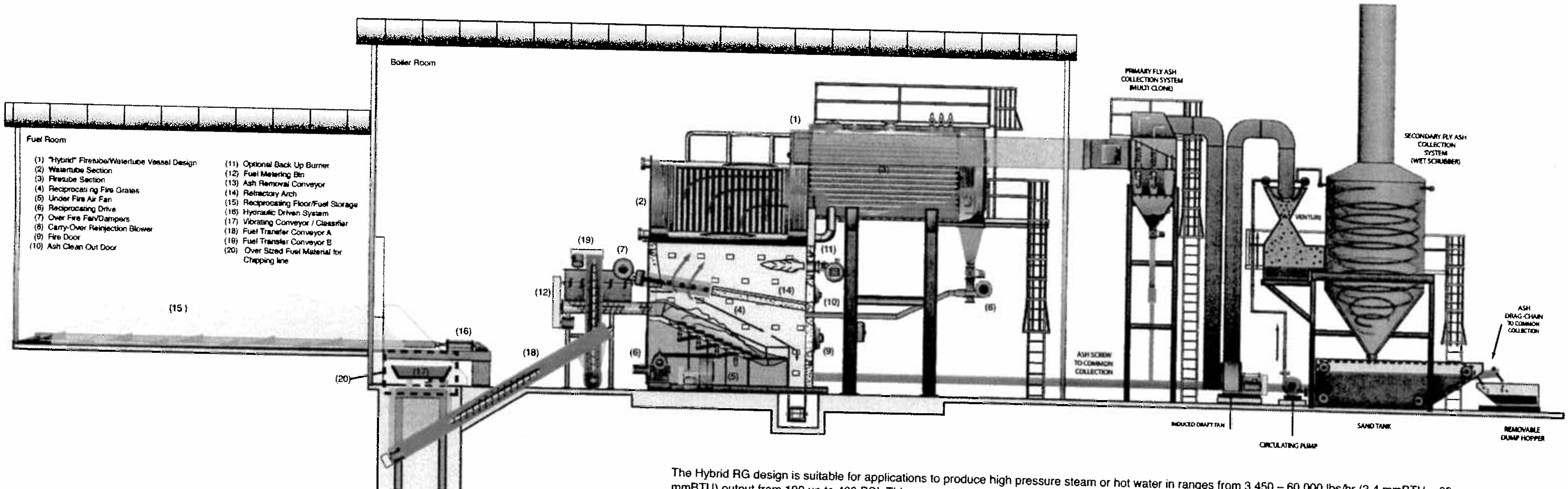
HURST **N65 FIREBOX HPD UF**

Modular Packaged

Under Fire Feed System

Reciprocating Grate
Combustion System

HURST



The Hybrid RG design is suitable for applications to produce high pressure steam or hot water in ranges from 3,450 – 60,000 lbs/hr (3.4 mmBTU – 60 mmBTU) output from 100 up to 400 PSI. This system is designed by HBC to combine the best technologies from the "old school" of biomass combustion and the latest advanced combustion control technologies. The new HBC reciprocating grate-type stoker system permits biomass fuels with a high proportion of incombustibles to be combusted in an efficient manner with the added advantage of automatic de-ashing. This combination is particularly suitable for heating applications in lumber dry kilns, veneer log vats, veneer dryers, greenhouses, factories, schools and office buildings. This combination enables these systems to provide a flexible and reliable operation utilizing a consistent "grade" of biomass waste with moisture contents ranging from 30 – 50%. The boiler vessel is a two pass hybrid design incorporating a water tubed boiler-type water membrane and a two-pass fire tube scotch marine vessel. This vessel's advantages over standard water tube boilers include much larger steam disengagement area providing high quality steam, larger steam storage capability for quicker response to sudden steam demand and much larger thermal storage that provides fast demand response times and safer operation.

The Hurst Venturi Scrubber uses the differential between high velocity gases and free-flowing water to create droplets which entrap contaminates, hold them in suspension and deliver them as a highly concentrated slurry. The Hurst Venturi Scrubber offers more advantages in separating and recovering liquid mist and ultra-fine particulate than other gas cleaning methods.

The Solid Fuel People

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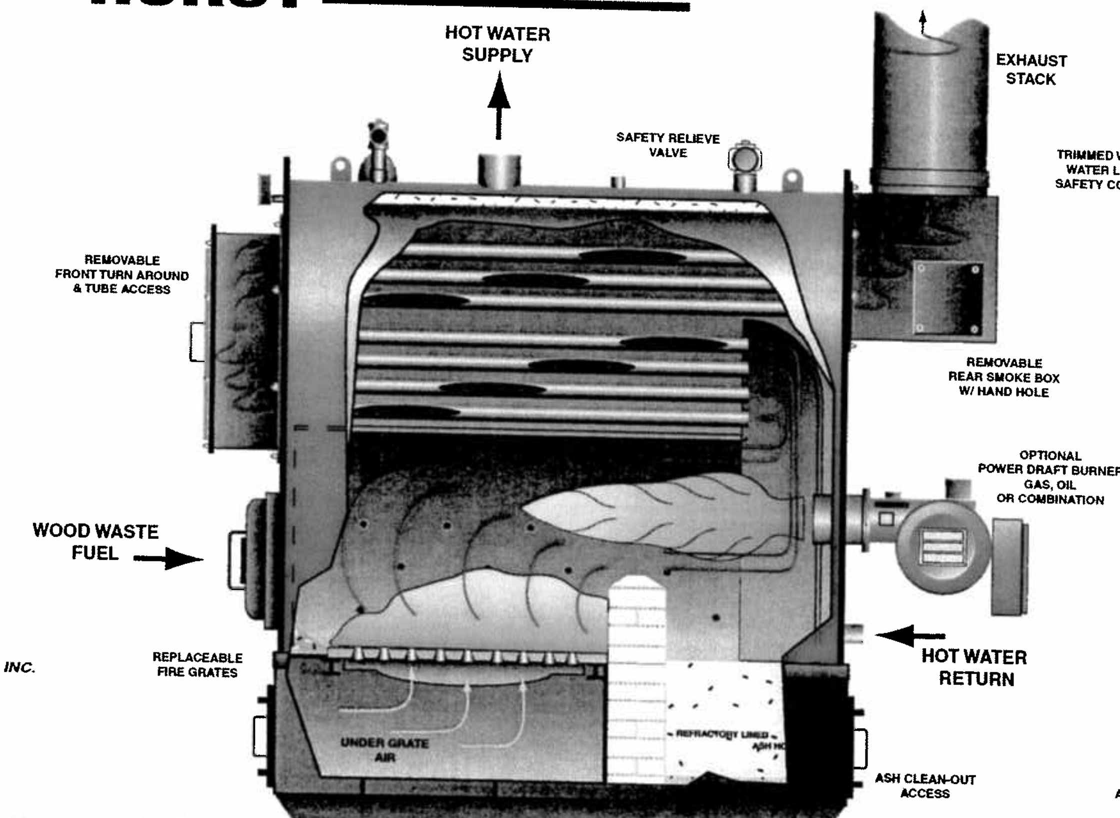
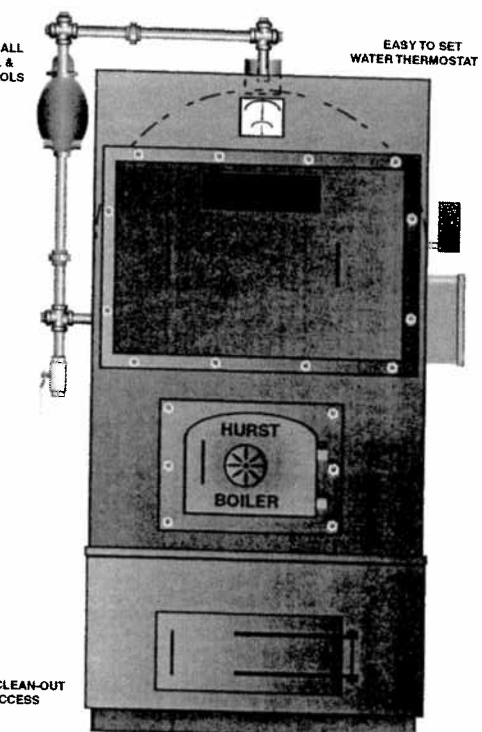
CAT # W-21 **HYBRID RG**

Reciprocating Grate System **Modular Packaged**

Hand Fired System

HURST The Solid Fuel People





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The FireBox LPD HF design is suitable for applications to produce low pressure steam or hot water in ranges from 3,450 – 20,700 lbs/hr (3.4 mmBTU – 20 mmBTU) output at 15 PSI steam or 30 PSI hot water. This system is designed by HBC to combine the best technologies from the "old school" of biomass combustion and the latest advanced combustion control technologies. HBC's new hand fired systems are particularly suited for operations with extremely low labor cost environments. This combination enables these systems to provide a flexible and reliable operation utilizing a wide range of biomass waste with moisture contents ranging from 8 – 50% and requiring minimal fuel preparation. Ash removal is a manual operation. The boiler vessel is a two pass hybrid design incorporating a water tubed boiler-type water membrane and a two-pass fire tube scotch marine vessel. The boiler vessel is a three-pass fire tube firebox design that inherently provides an extended water membrane in the furnace area greatly reducing the amount of refractory required.

CAT# W-01

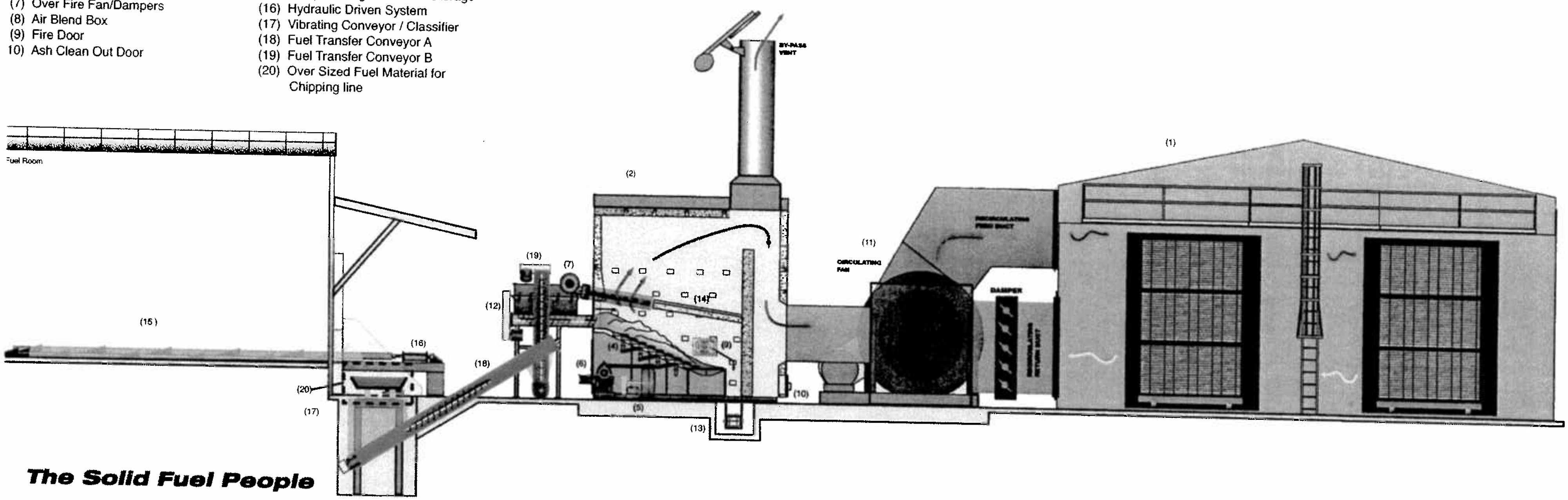
HURST FIREBOX LPD HF

MULTI FUEL 50,100 & 150 HP — Hand Fired System — **Modular Packaged**

Reciprocating Grate
Combustion System

HURST

(1) Dry Kiln
(2) Hurst Green Burner Furnace
(4) Reciprocating Fire Grates
(5) Under Fire Air Fan
(6) Reciprocating Drive
(7) Over Fire Fan/Dampers
(8) Air Blend Box
(9) Fire Door
10) Ash Clean Out Door
(11) Circulating Air System
(12) Fuel Metering Bin
(13) Ash Removal Conveyor
(14) Refractory Arch
(15) Reciprocating Floor/Fuel Storage
(16) Hydraulic Driven System
(17) Vibrating Conveyor / Classifier
(18) Fuel Transfer Conveyor A
(19) Fuel Transfer Conveyor B
(20) Over Sized Fuel Material for Chipping line



The Solid Fuel People

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CAT # W-23

GREEN BURNER RG

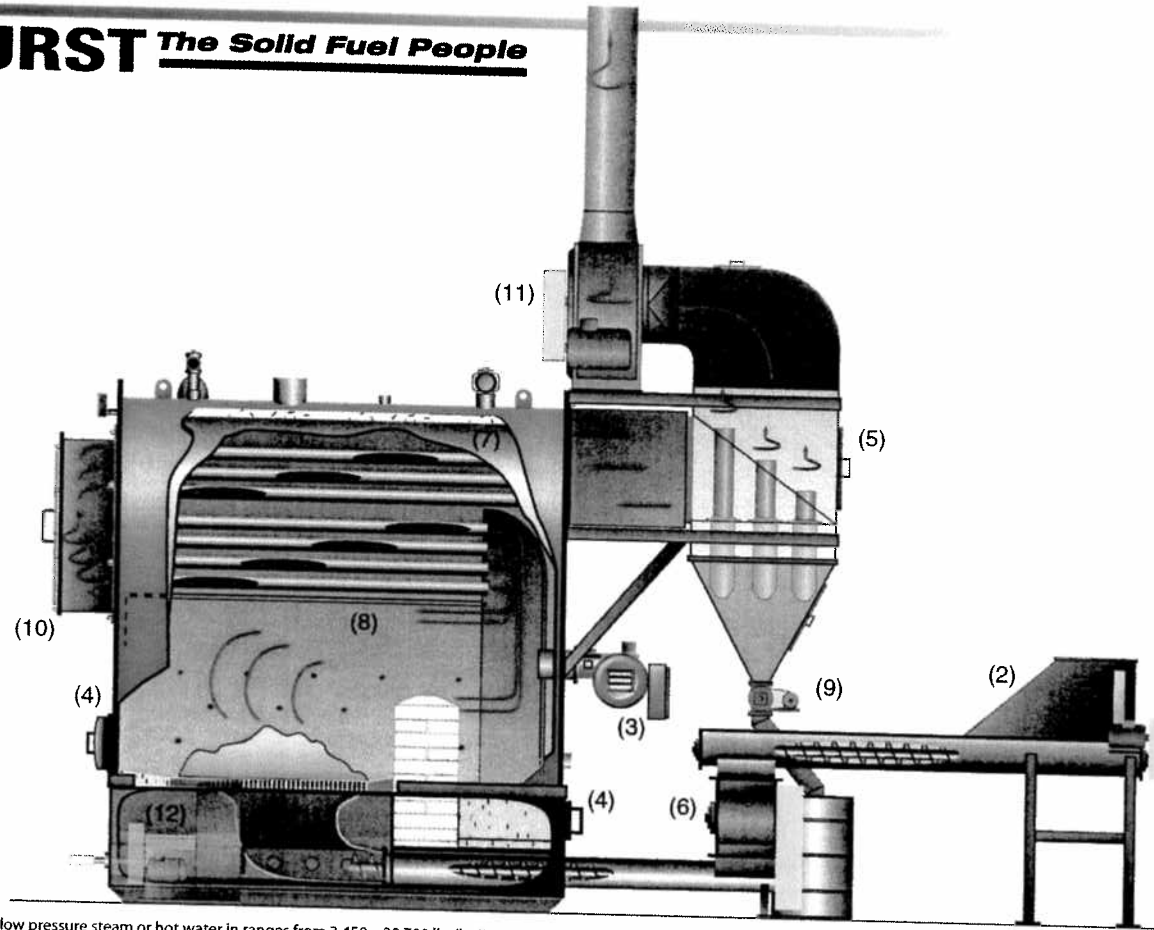
Reciprocating Grate System — Modular Packaged

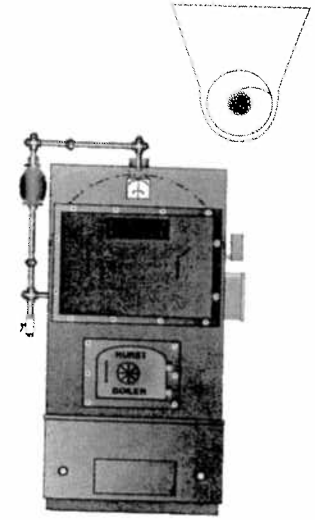
HURST BOILER & WELDING COMPANY, INC.

HURST The Solid Fuel People

Under Feed Stoker
Combustion System

(1) Cast Alloy Under Fire Stoker
(2) Fuel Metering Bin
(3) Optional (gas/oil) Burner
(4) Fire Door/Clean-Out
(5) Fly-Ash Collection System
(6) Rotary Air Lock Fuel Feeder
(7) 3-pass Wet Back Boiler
(8) Packaged Combustion Chamber
(9) Rotary Air Lock/Fly-Ash Dump
(10) Tube Cleaning Acess
(11) Induce Draft Fan
(12) Under Fire Air fan





Low Pressure FireBox Design

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The FireBox LPD UF design is suitable for applications to produce low pressure steam or hot water in ranges from 3,450 – 20,700 lbs/hr (3.4 mmBTU – 20 mmBTU) output at 15 PSI steam or 30 PSI hot water. This system is designed by HBC to combine the best technologies from the "old school" of biomass combustion and the latest advanced combustion control technologies. HBC's new hand fired systems are particularly suited for operations with extremely low labor cost environments. This combination enables these systems to provide a flexible and reliable operation utilizing a wide range of biomass waste with moisture contents ranging from 8 – 50% and requiring minimal fuel preparation. Ash removal Is a manual operation. The boiler vessel is a two pass hybrid design incorporating a water tubed boiler-type water membrane and a two-pass fire tube scotch marine vessel. The boiler vessel is a three-pass fire tube firebox design that inherently provides an extended water membrane in the furnace area greatly reducing the amount of refractory required.

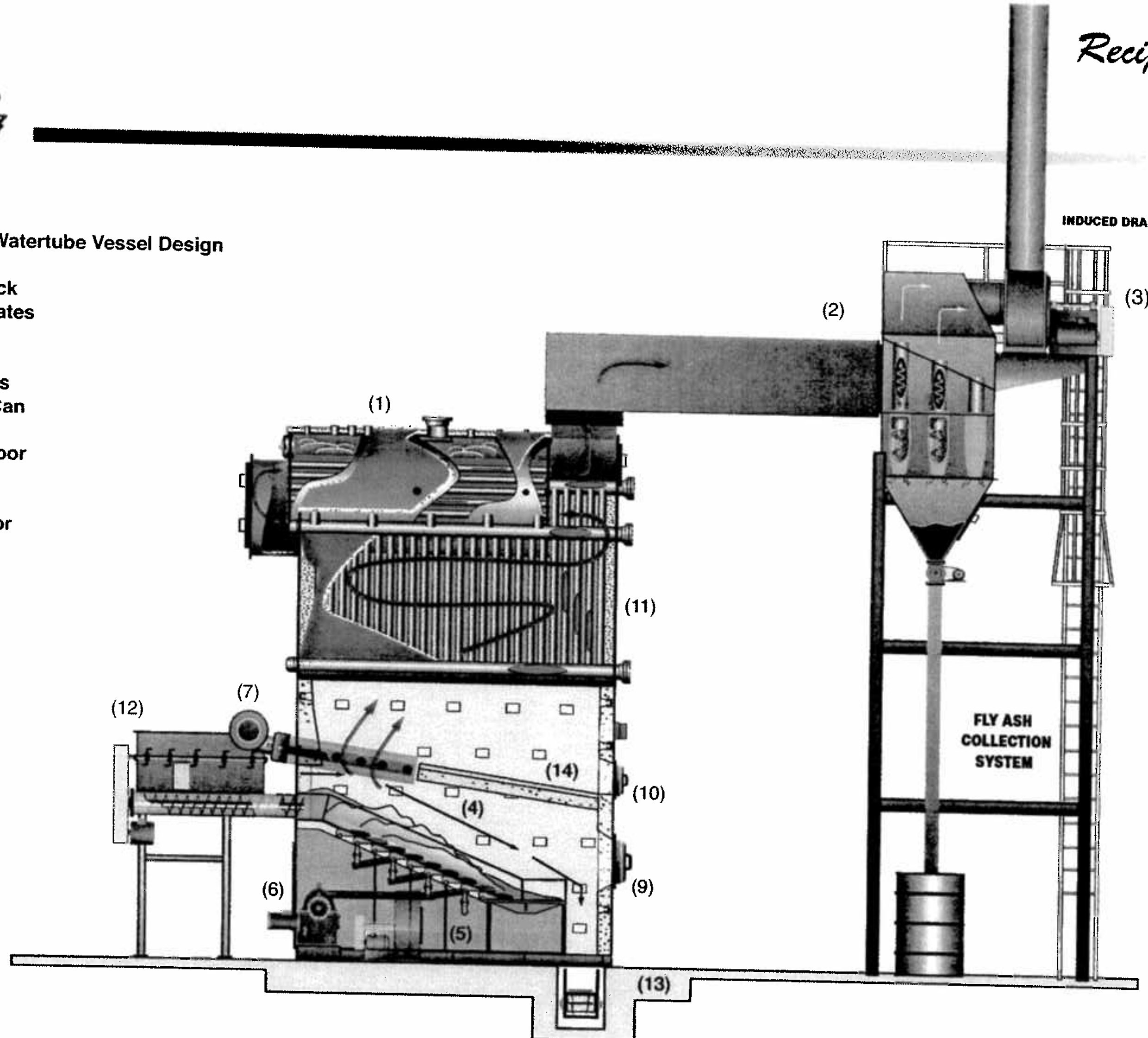
CAT# W-03

FIREBOX LPD UF

MULTI FUEL — **Under Fire Feed System** — **Modular Packaged**

Reciprocating Grate
Combustion System

(1) "FIREBOX" Firetube/Watertube Vessel Design
(2) Ash Collector
(3) Induced Draft fan/stack
(4) Reciprocating Fire Grates
(5) Under Fire Air Fan
(6) Reciprocating Drive
(7) Over Fire Fan/Dampers
(8) Rotary Ash Dump to Can
(9) Fire Door
(10) Aux. Ash Clean Out Door
(11) Watertube Section
(12) Fuel Metering Bin
(13) Ash Removal Conveyor
(14) Refractory Arch



MORE MODELS CHOICES SOLUTIONS

- Efficient 3-Pass Design.
- Water "Leg" Side Walls (High Efficiency Tubed Membrane)
- Wet-Back Construction.
- A.S.M.E. Code Constructed & Stamped.
- Registered with National Board of Inspectors.
- Large Water Cooled Furnace.
- Burner Mounting Ring.
- 16" Rear Access Port.
- Ample Water-Side Clean-out Opening.
- 2" High Temp Insulation.
- Powder Coat Finish on Lagging.
- UL Listed Controls & Trim.
- Open Bottom for Stoker Firing of Solid Fuel.
- Hinged Front & Rear Doors.

150
250
300
450 **PSI**
High Pressure Design

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CAT # W-24

HURST N65 FIREBOX RG

Reciprocating Grate System **Modular Packaged**

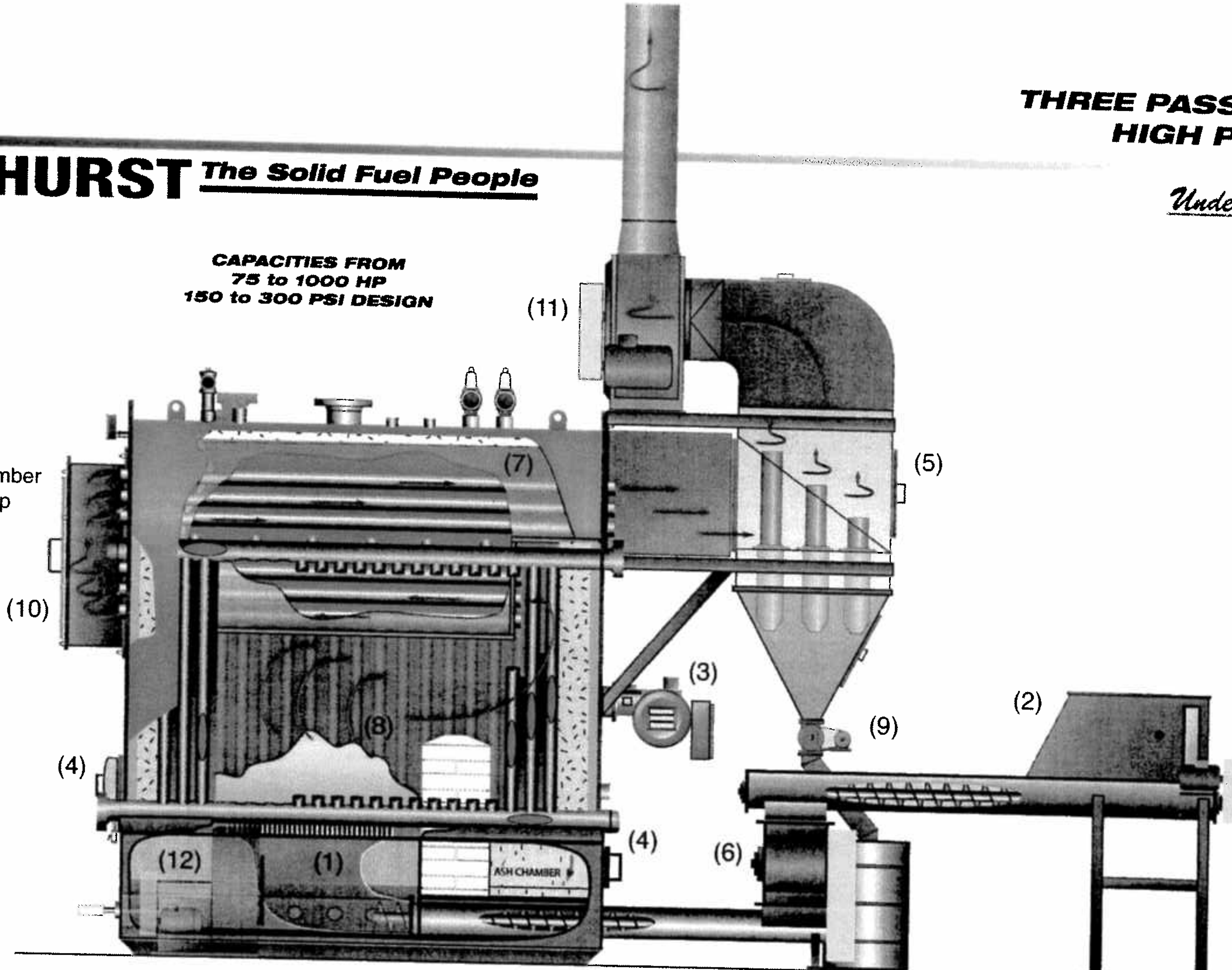
HURST The Solid Fuel People

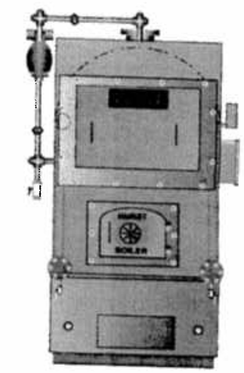
THREE PASS FIREBOX HIGH PRESSURE

Under Feed Stoker Combustion System

CAPACITIES FROM 75 to 1000 HP 150 to 300 PSI DESIGN

(1) Cast Alloy Under Fire Stoker
(2) Fuel Metering Bin
(3) Optional (gas/oil) Burner
(4) Fire Door/Clean-Out
(5) Fly-Ash Collection System
(6) Rotary Air Lock Fuel Feeder
(7) 3-pass HYBRID Boiler
(8) Water Wall Combustion Chamber
(9) Rotary Air Lock/Fly-Ash Dump
(10) Tube Cleaning Acess
(11) Induce Draft Fan
(12) Under Fire Air fan





Water Wall FireBox Design

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The FireBox HPD UF design is suitable for applications to produce high pressure steam at 150 to 300 PSI. This system is designed by HBC to combine the best technologies from the "old school" of biomass combustion and the latest advanced combustion control technologies. HBC's under feed stoker systems are suited to burn an arry of solid fuels. Ash removal is a manual operation. The boiler vessel is a two pass hybrid firetube / watertube design incorporating a water tubed boiler-type water wall membrane and a two-pass fire tube scotch marine vessel. The combined boiler vessel is a three-pass fire tube firebox design that inherently provides an extended water membrane in the furnace area greatly reducing the amount of furnace maintenance and refractory replacement.

CAT # W-20A

FIREBOX HPD UF

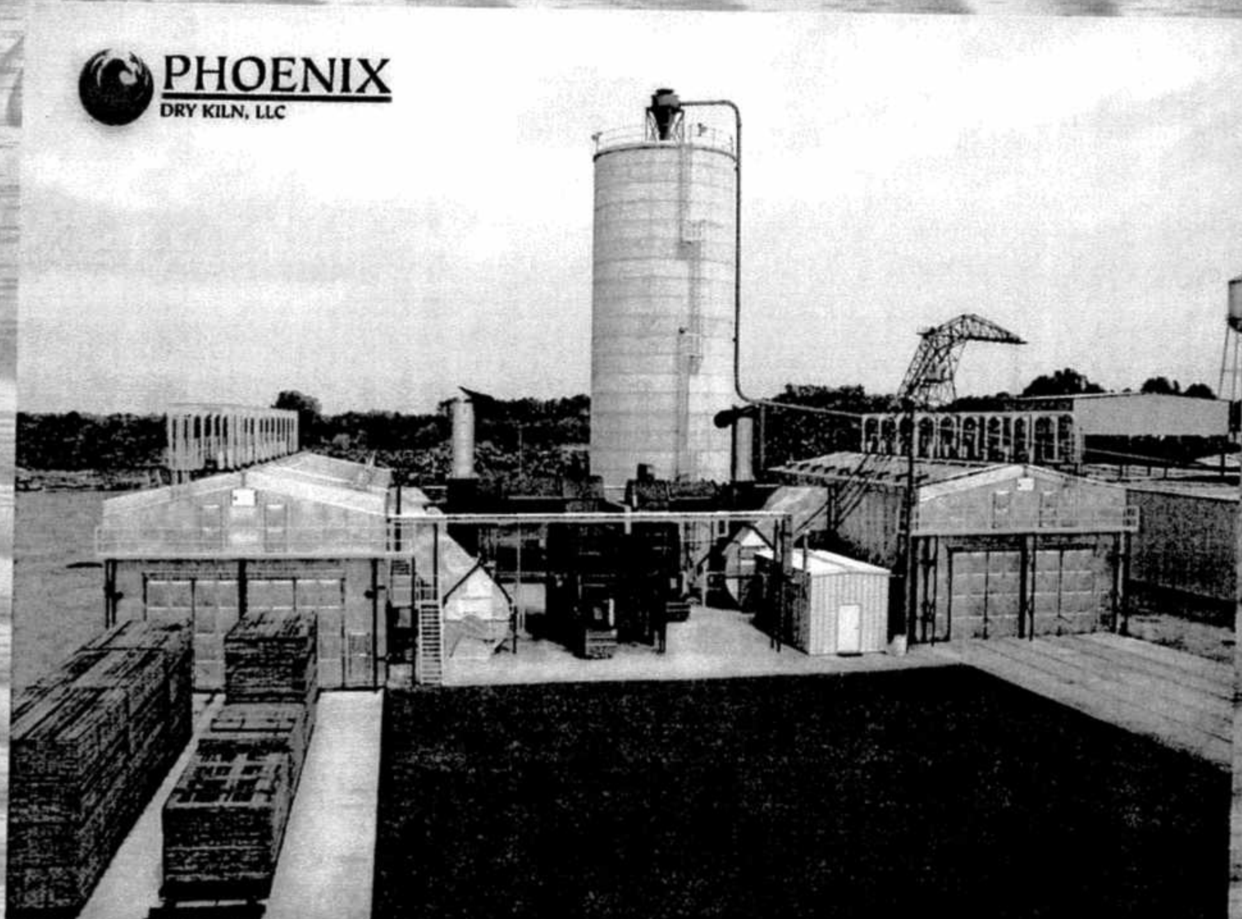
MULTI FUEL

Under Fire Feed System **Modular Packaged**

Green Burner

HURST

- Superior refractory liner concept.
- Simplified permitting compared with steam boiler system.
- Matched and balanced design "Hurst" direct burner combustion system with the "Phoenix" TRUE-FLOW lumber kiln.



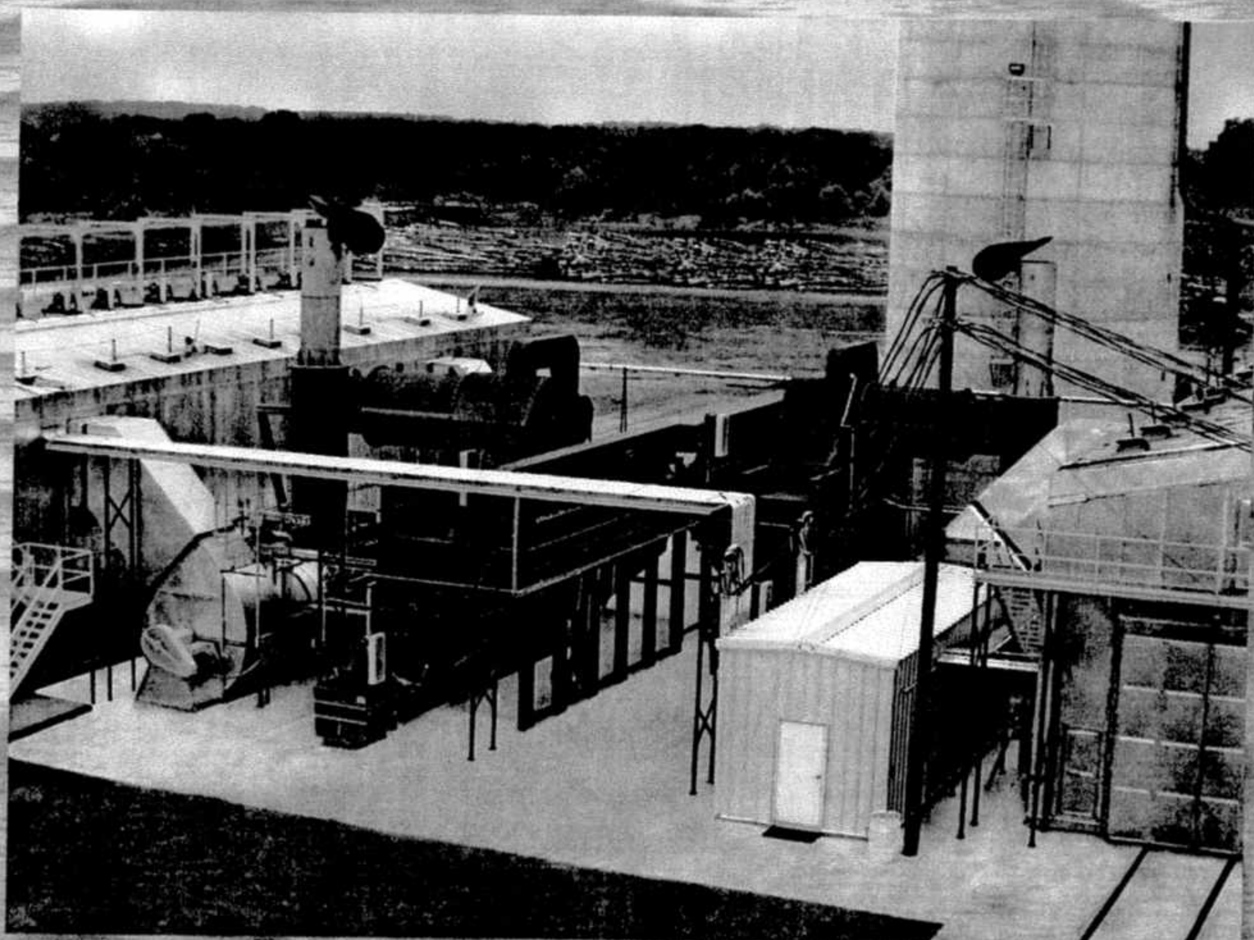
Direct Fired

Lumber Drying Systems

- Lower bottom line cost of lumber drying.
- Construction cost lower than conventional steam boiler with coil drying system.
- Totally automated design includes fuel feed and self cleaning furnace.

Utilize your plants own waste to dry lumber with the direct-fired burner. Sawdust can be charged from optional fuel storage devices or feed directly into the conveyor hopper. This unit utilizes the time-proven slope-grate gasifier method to produce the heat for the kiln in a method that is cleaner than traditional direct-fired kilns.

The system features "chain overfeed" charging and a clean-sweeping ash chain for removal. Special metallurgy discourages most internal grate corrosion for longer lasting internals. Unique wall/grate interlocking discourages internal fuel leakage that can require frequent cleaning and potentially shorten the life of the grates and the burner.



Hurst direct-fired furnace systems are available for lumber drying applications in the forest related industries. The systems are designed for your specific fuel and can be fired with wet waste material up to 60% moisture content or low moisture content dry fuels. The exact system design is based on the fuel that you have available.

Phoenix Dry Kilns LLC is a joint venture between Hurst Boiler and Welding Co. Inc. and Phoenix Manufacturing Services, Inc. Hurst Boiler is a 38 year veteran in the steam boiler and combustion industry and manufactures a full line of gas, oil, coal and wood fired boilers.

Phoenix kilns are designed for simplicity of operation with minimal manpower requirements and maximum production throughput capabilities. All kilns offer fully automated operation; user friendly interface control; unmanned operation with remote control & monitoring; and alarming notification capabilities.

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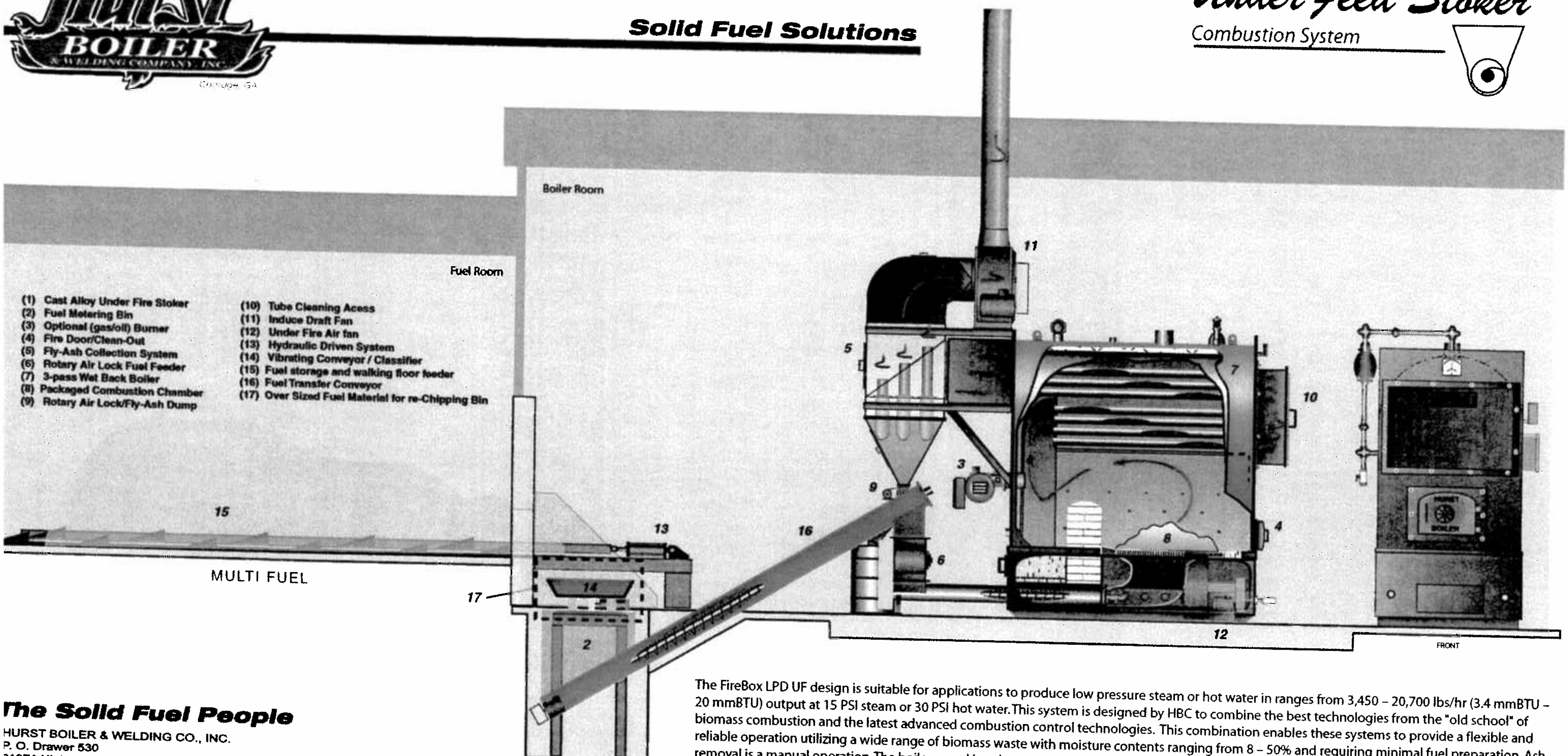
Hurst Boiler The Solid Fuel People

Solid Fuel Solutions

UnderFeed Stoker

Combustion System



The FireBox LPD UF design is suitable for applications to produce low pressure steam or hot water in ranges from 3,450 – 20,700 lbs/hr (3.4 mmBTU – 20 mmBTU) output at 15 PSI steam or 30 PSI hot water. This system is designed by HBC to combine the best technologies from the "old school" of biomass combustion and the latest advanced combustion control technologies. This combination enables these systems to provide a flexible and reliable operation utilizing a wide range of biomass waste with moisture contents ranging from 8 – 50% and requiring minimal fuel preparation. Ash removal is a manual operation. The boiler vessel is a three-pass firetube / firebox design that inherently provides an extended water membrane in the furnace area greatly reducing the amount of refractory required.

The Solid Fuel People

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CAT# W-11

HURST FIREBOX LPD UF

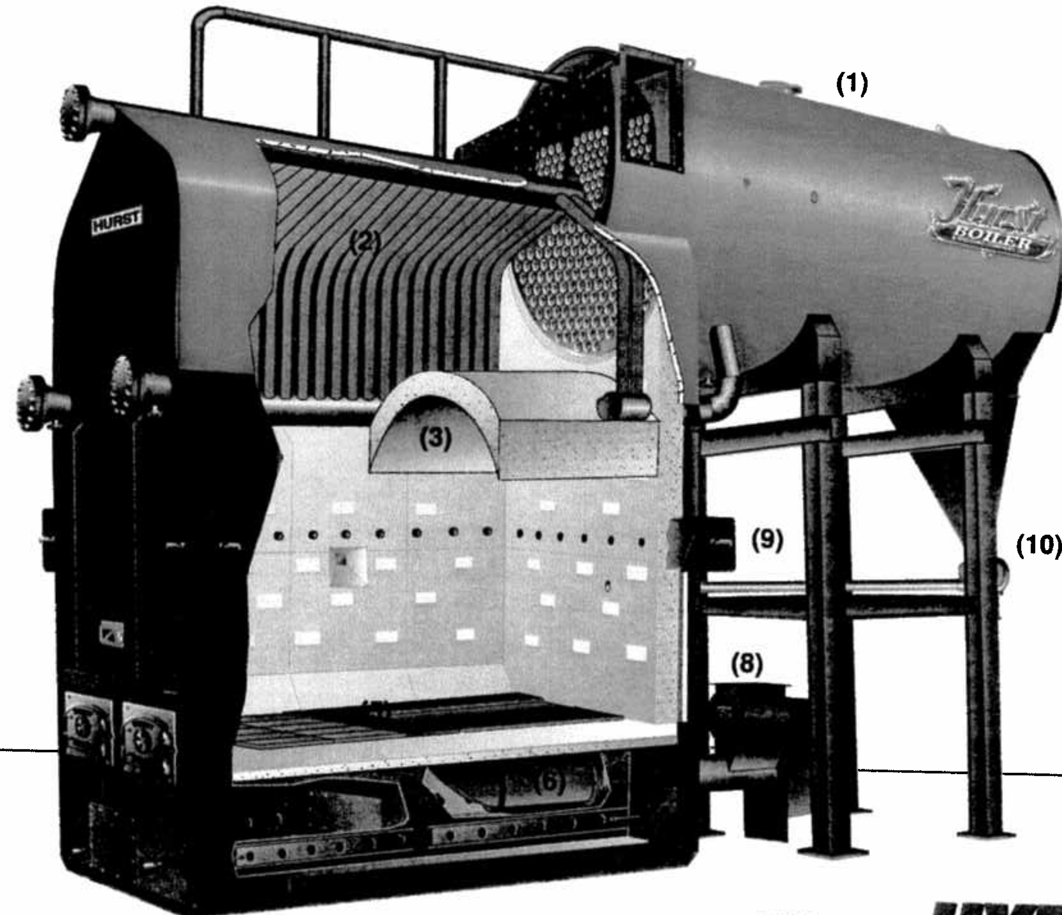
Modular Packaged

Under Fire Feed System

HURST The Solid Fuel People

UnderFeed Stoker
Combustion System

(1) Hybrid Firetube/Watertube Vessel Design
(2) Watertube Section
(3) Radiant Arch
(4) Combustion Chamber
(5) Cast Grates
(6) Under Fire Fuel Retort
(7) Air Control Dampers
(8) Rotary Air Lock Fuel Feeder/Stoker Screw
(9) Over Fire Air System
(10) Ash Reinjection Blower
(11) Fire Doors



The Hybrid UF design is suitable for applications to produce high pressure steam or hot water in ranges from 3,450 – 60,000 lbs/hr (3.4 mmBTU – 60 mmBTU) output from 100 up to 400 PSI. This system is designed by HBC to combine the best technologies from the "old school" of biomass combustion and the latest advanced combustion control technologies. With hundreds of these systems in operation, HBC's Under Feed Stoker Systems have proven their ability to provide a very low turn-down rate making it particularly suitable for heating applications in lumber dry kilns, veneer log vats, veneer dryers, greenhouses and factories. This combination enables these systems to provide a flexible and reliable operation utilizing a consistent "grade" of biomass waste with moisture contents ranging from 8 – 50%. Ash removal is a manual operation. The boiler vessel is a two pass hybrid design incorporating a water tubed boiler-type water membrane and a two-pass fire tube scotch marine vessel. This vessel's advantages over standard water tube boilers include much larger steam disengagement area providing high quality steam, larger steam storage capability for quicker response to sudden steam demand and much larger thermal storage that provides fast demand response times and safer operation.

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CAT# W-07

HURST HYBRID UF

Under Fire Feed System — Modular Packaged

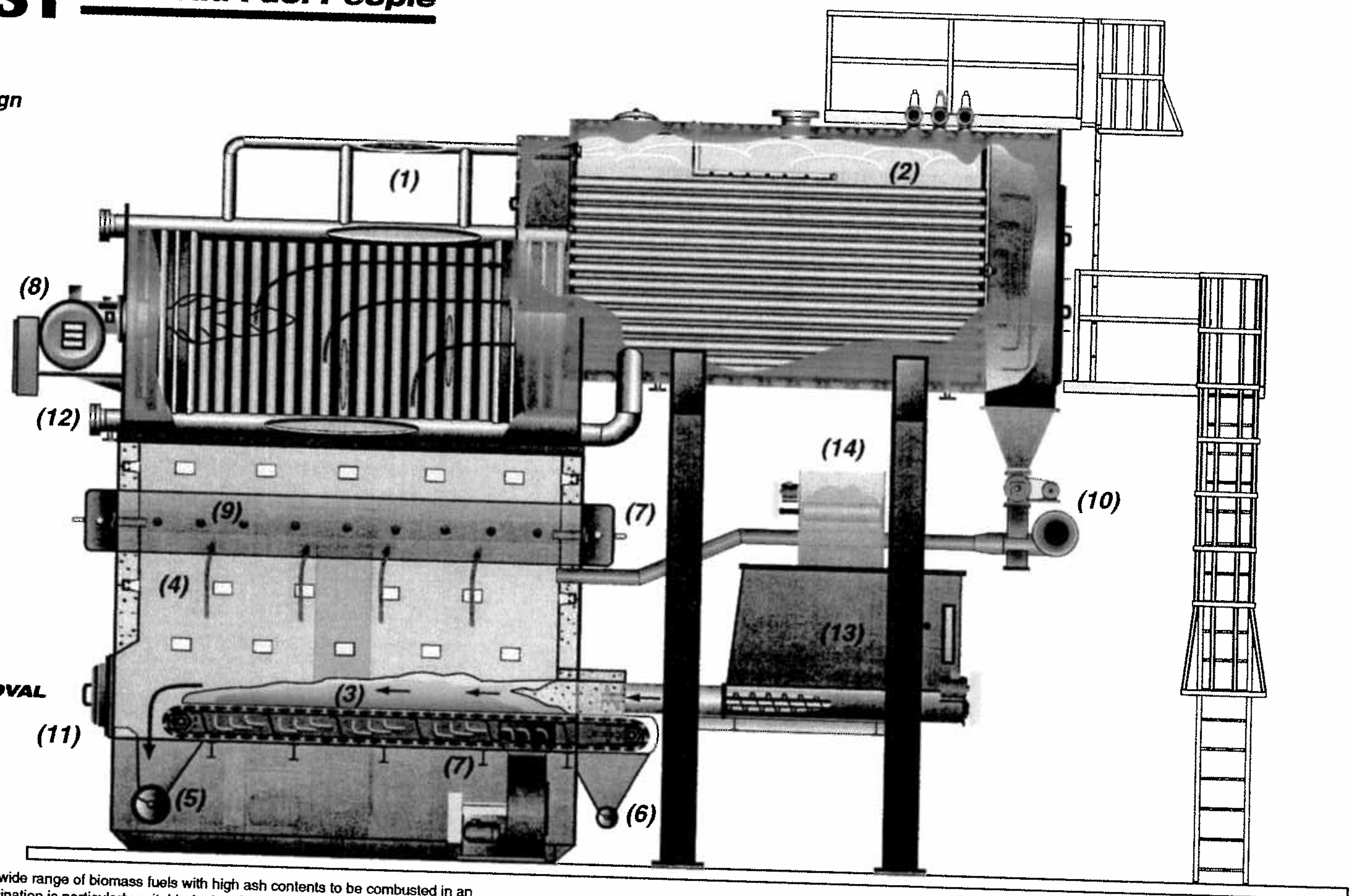
HURST BOILER & WELDING COMPANY, INC.

HURST The Solid Fuel People

Revolving Stoker Bed

Chain Grate Combustion System

(1) Hybrid Firetube/Watertube Vessel Design
(2) Watertube Section
(3) Chain Grate Stoker System
(4) Combustion Chamber
(5) Primary Ash Collection Screw
(6) Secondary Ash Removal Screw
(7) Air Control Dampers
(8) Optional Gas/Oil Back Up Burner
(9) Over Fire Air System
(10) Ash Reinjection Blower
(11) Fire Doors
(12) Water-Side Inspection Ports
(13) Twin Screw Fuel Metering Bin
(14) Fuel Supply Conveyor



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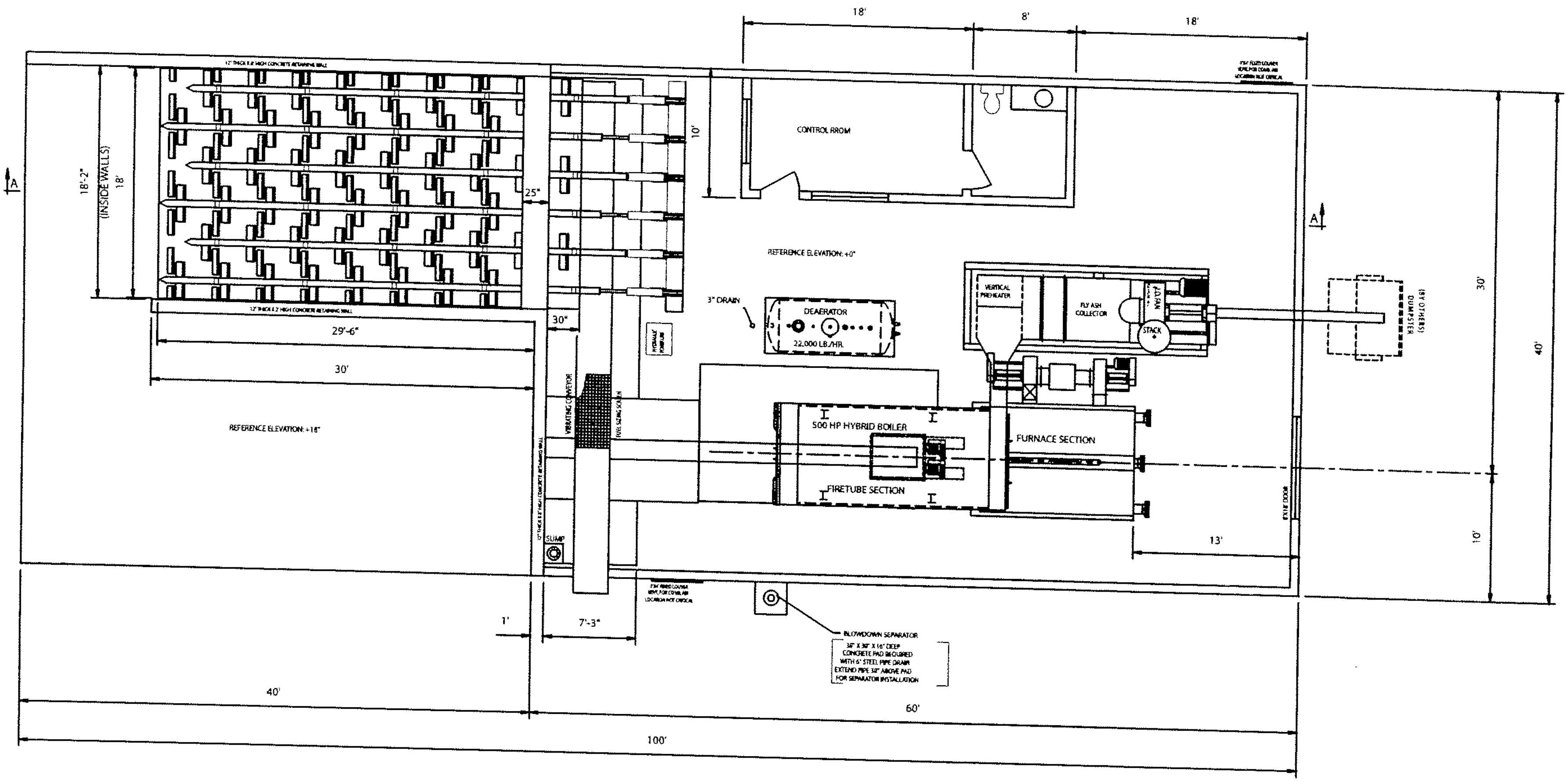
The Hybrid CG design is suitable for applications to produce high pressure steam or hot water in ranges from 3,450 – 60,000 lbs/hr (3.4 mmBTU – 60 mmBTU) output from 100 up to 400 PSI. This system is designed by HBC to combine the best technologies from the "old school" of biomass combustion and the latest advanced combustion control technologies. The new HBC chain grate-type stoker system permits a wide range of biomass fuels with high ash contents to be combusted in an efficient manner with the added advantage of automatic de-ashing. This combination is particularly suitable for heating applications in lumber dry kilns, veneer log vats, veneer dryers, greenhouses, factories, schools and office buildings. This combination enables these systems to provide a flexible and reliable operation utilizing a consistent "grade" of biomass waste with moisture contents ranging from 30 – 50%. The boiler vessel is a two pass hybrid design incorporating a water tubed boiler-type water membrane and a two-pass fire tube scotch marine vessel. This vessel's advantages over standard water tube boilers include much larger steam disengagement area providing high quality steam, larger steam storage capability for quicker response to sudden steam demand and much larger thermal storage that provides fast demand response times and safer operation.

CAT# W-04

HURST HYBRID CG

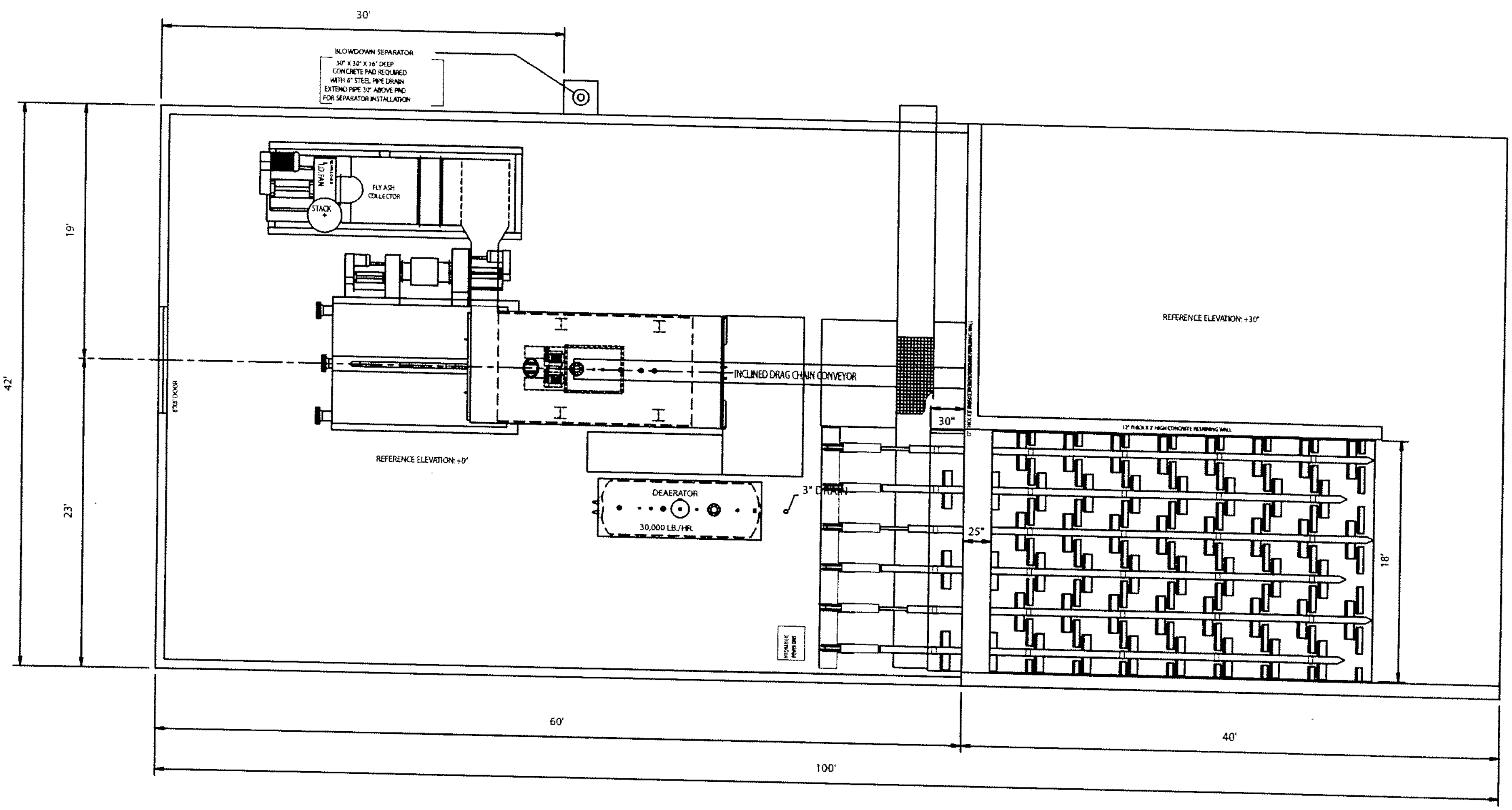
Revolving Chain Grate System

Modular Packaged



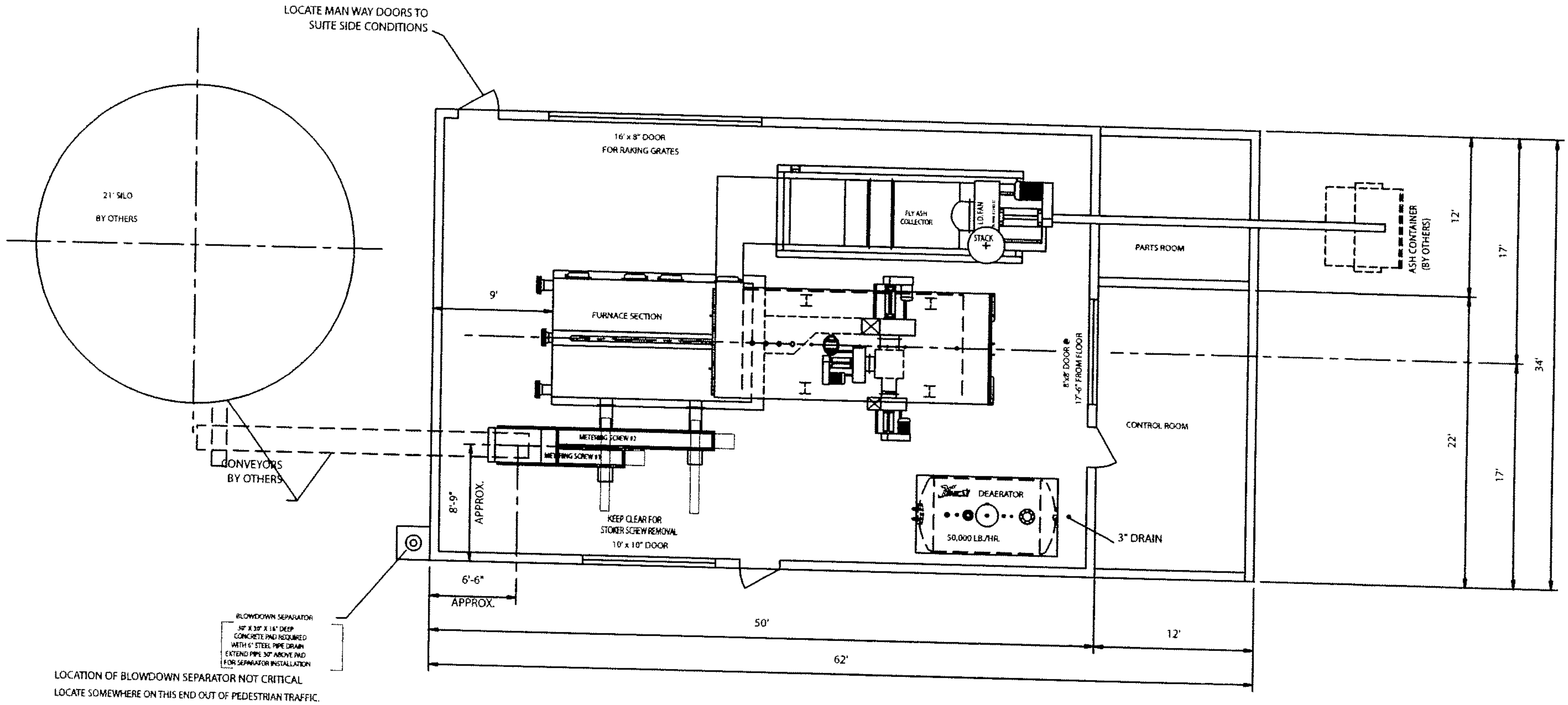
PLAN VIEW

SFD# 500 HP
Hybrid w/ walking floor
fuel feed system.

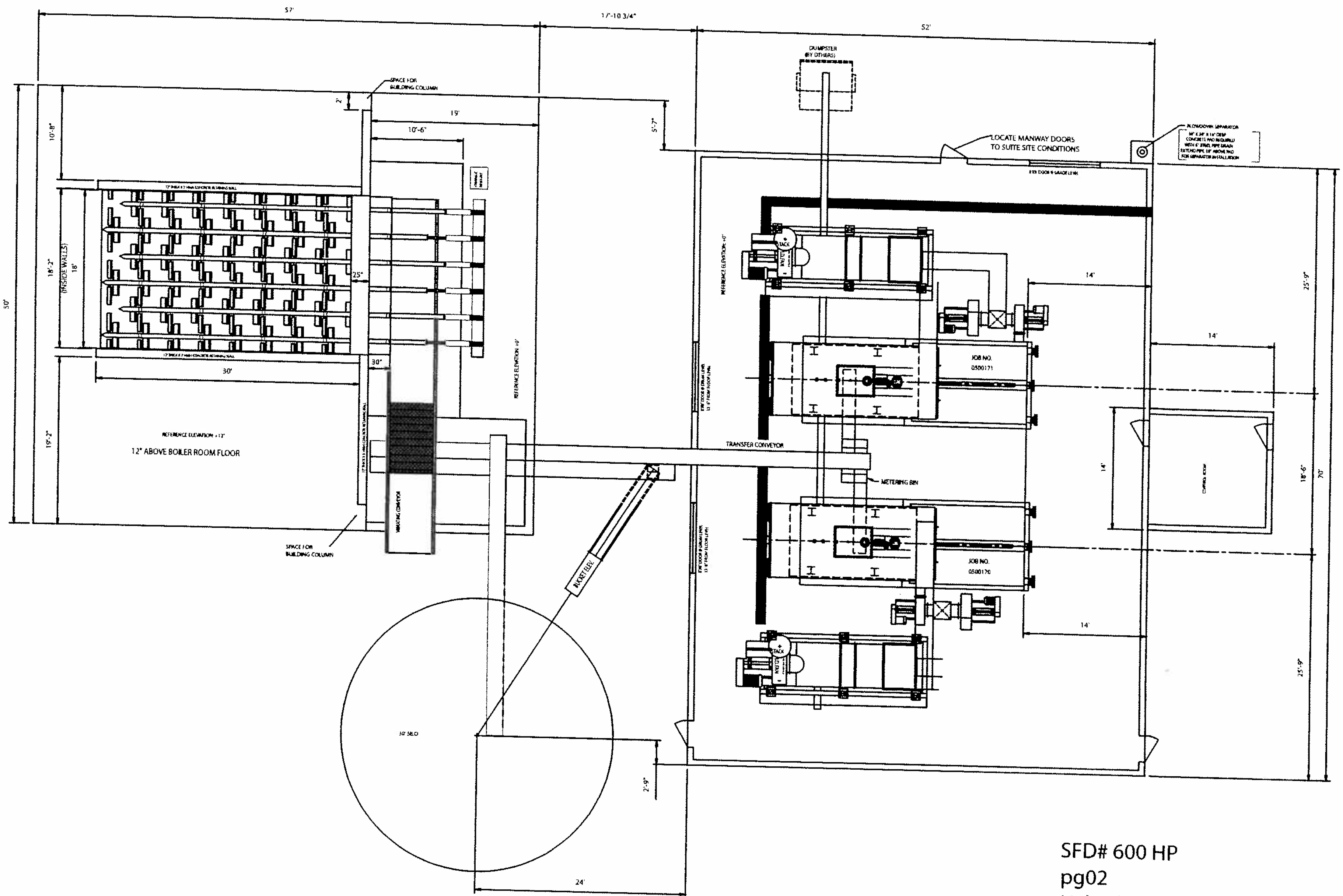


PLAN VIEW

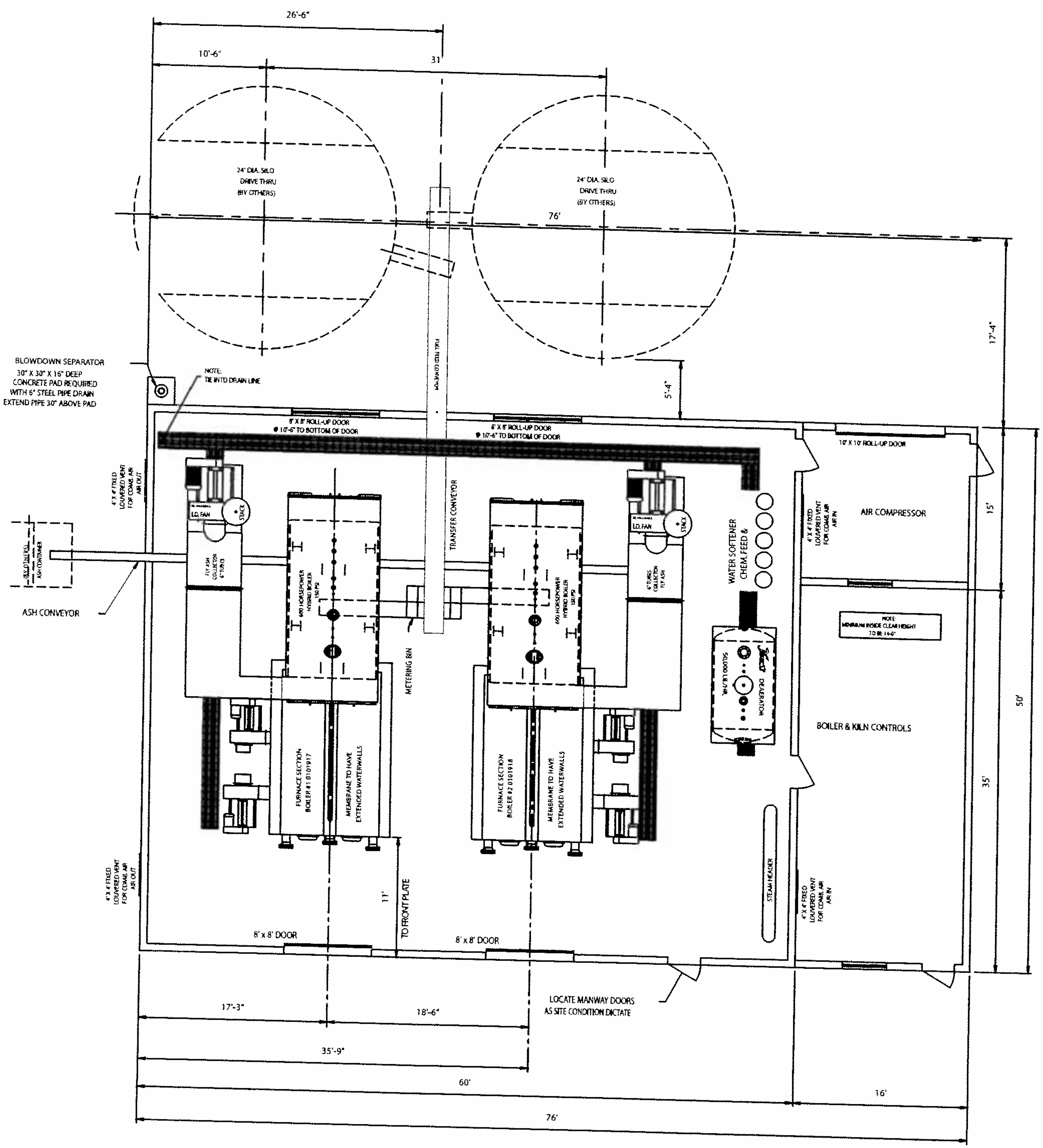
SFD# 600 HP
pg01
Hybrid w/ walking floor
fuel feed system.



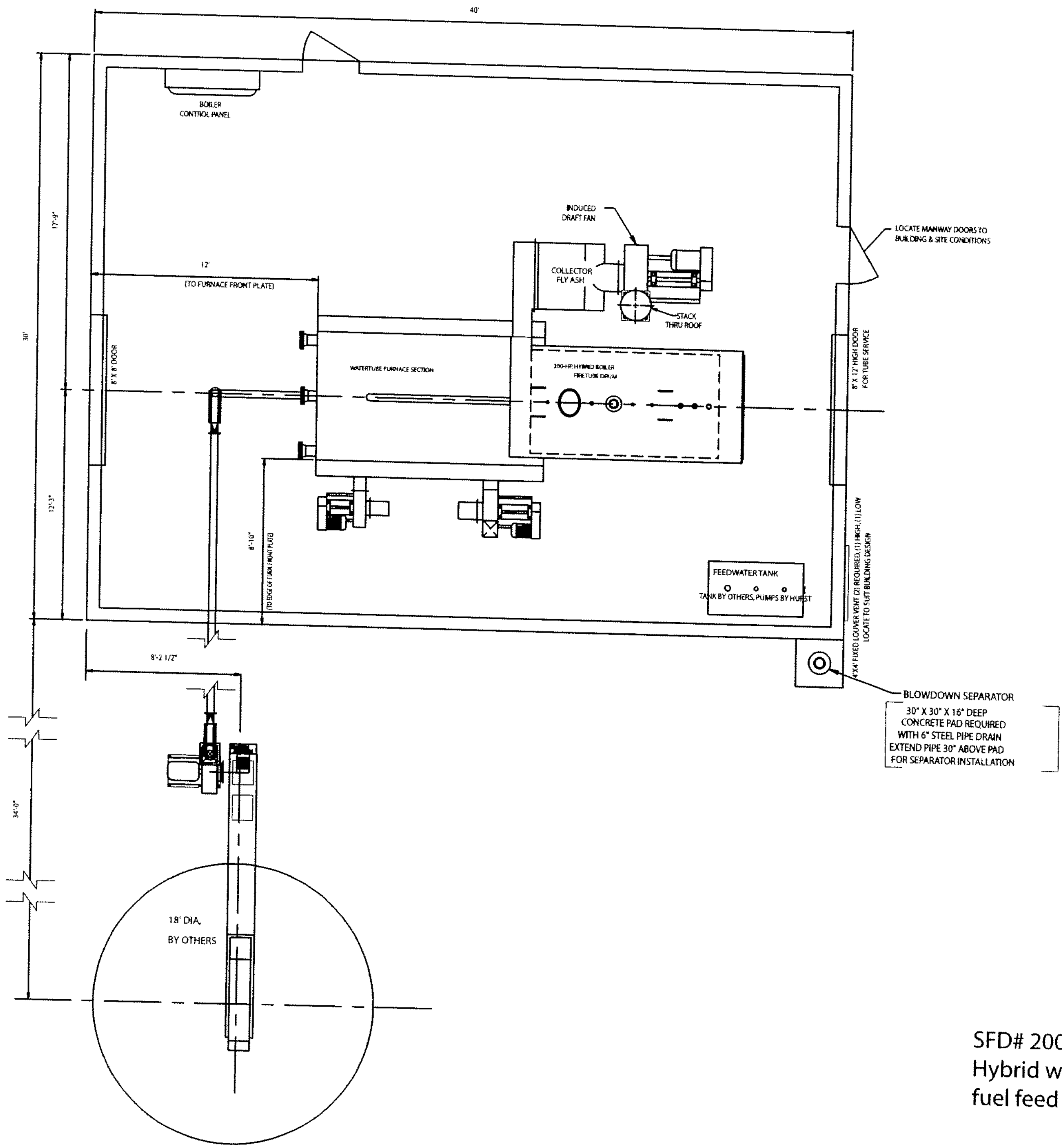
SFD# 600 HP
pg03
Hybrid w/ silo
fuel feed system.



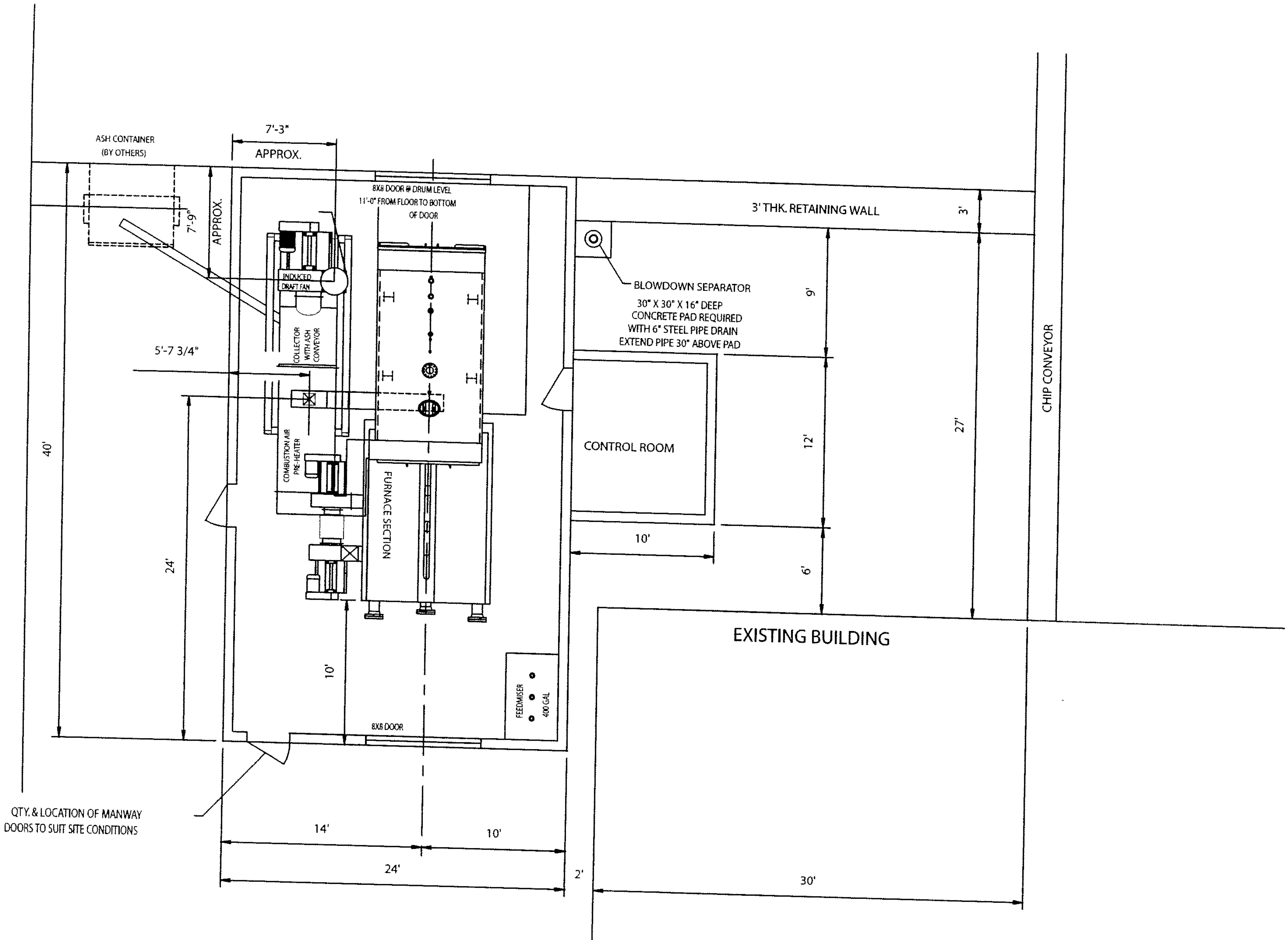
SFD# 600 HP
pg02
Hybrid w/ walking floor
fuel feed system.



SFD# 600 HP
pg04
Hybrid w/ silo
fuel feed system.

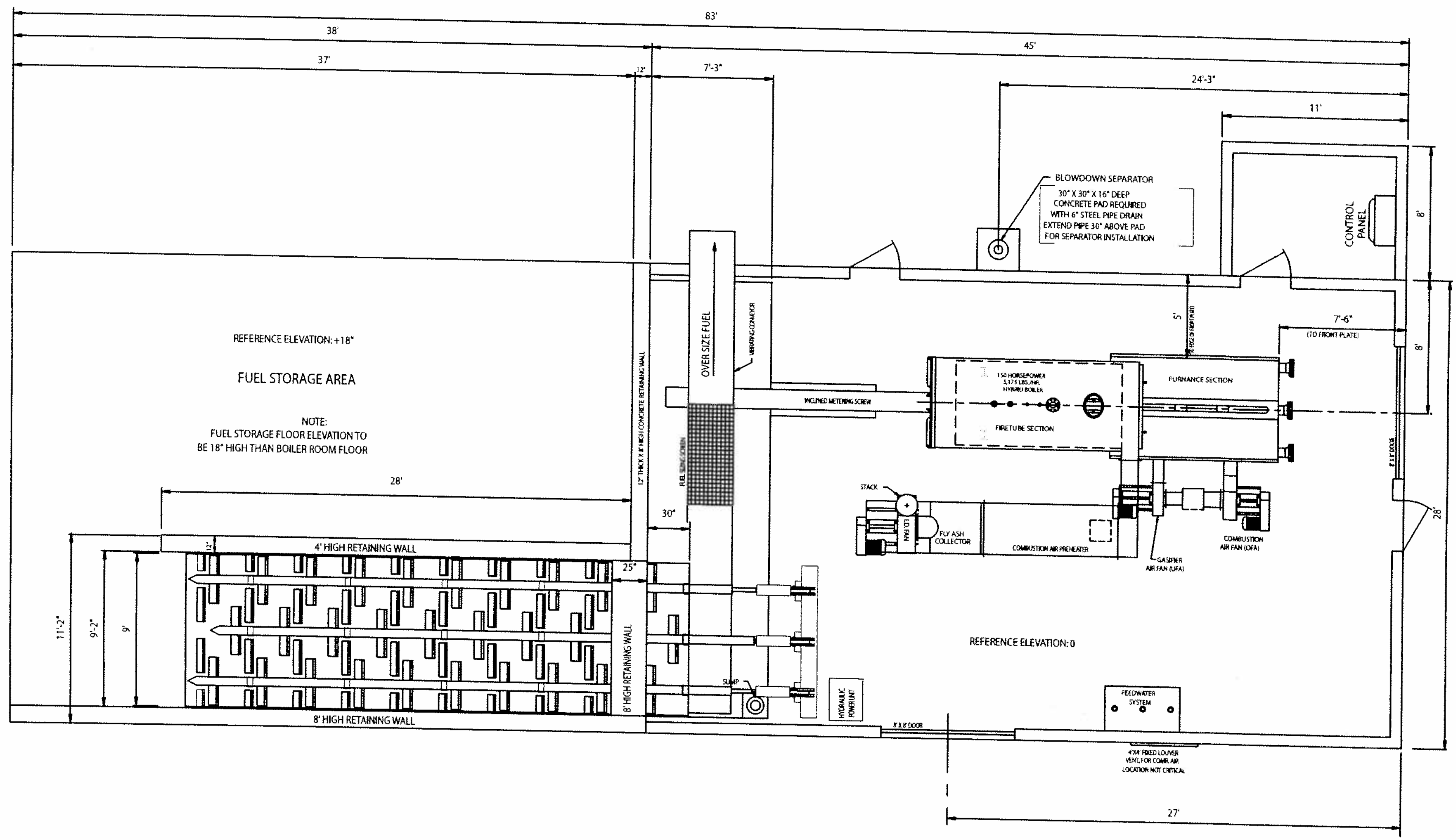


SFD# 200 HP
Hybrid w/ silo
fuel feed system.

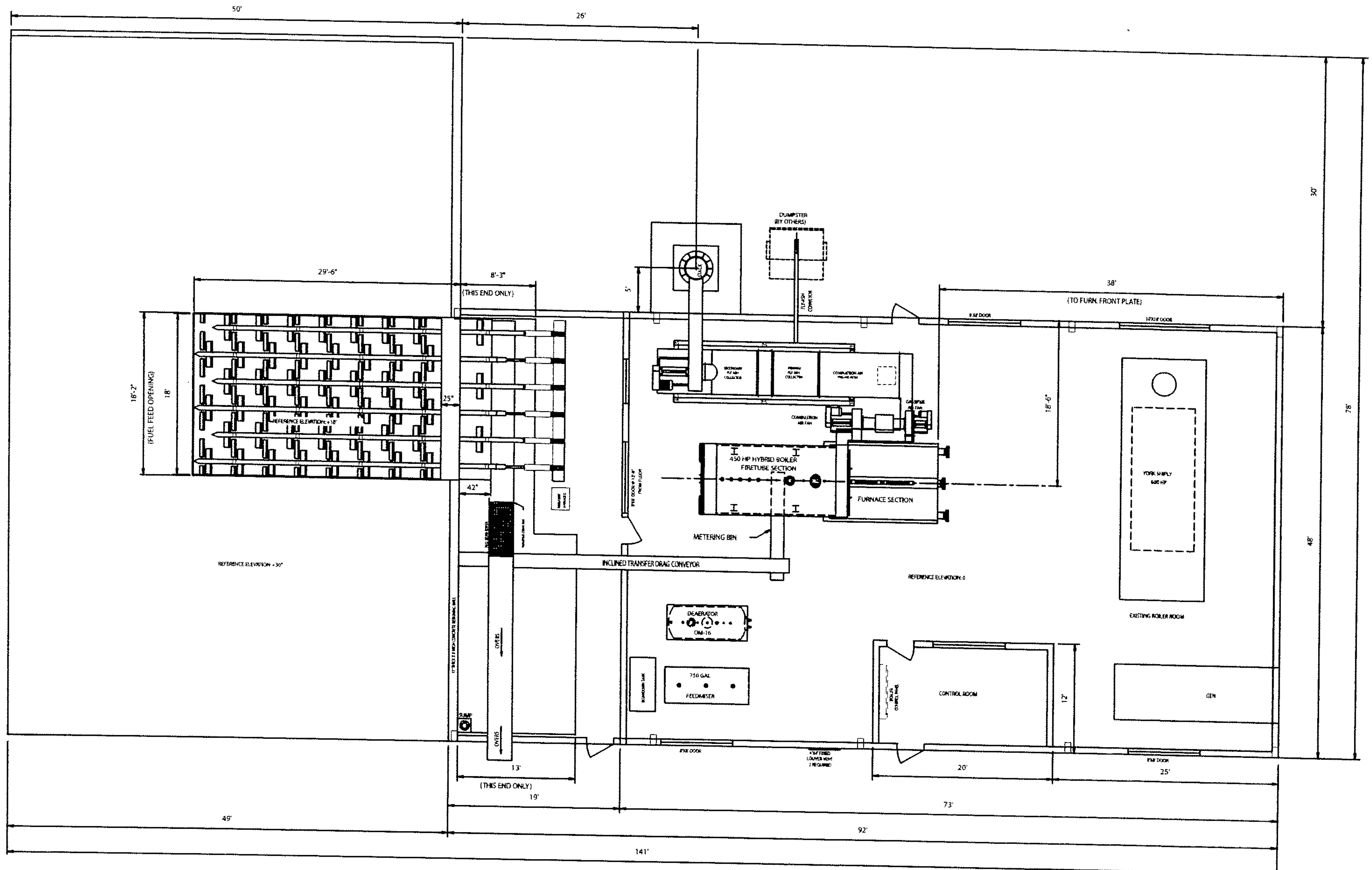


PLAN VIEW

SFD# 400 HP
Hybrid

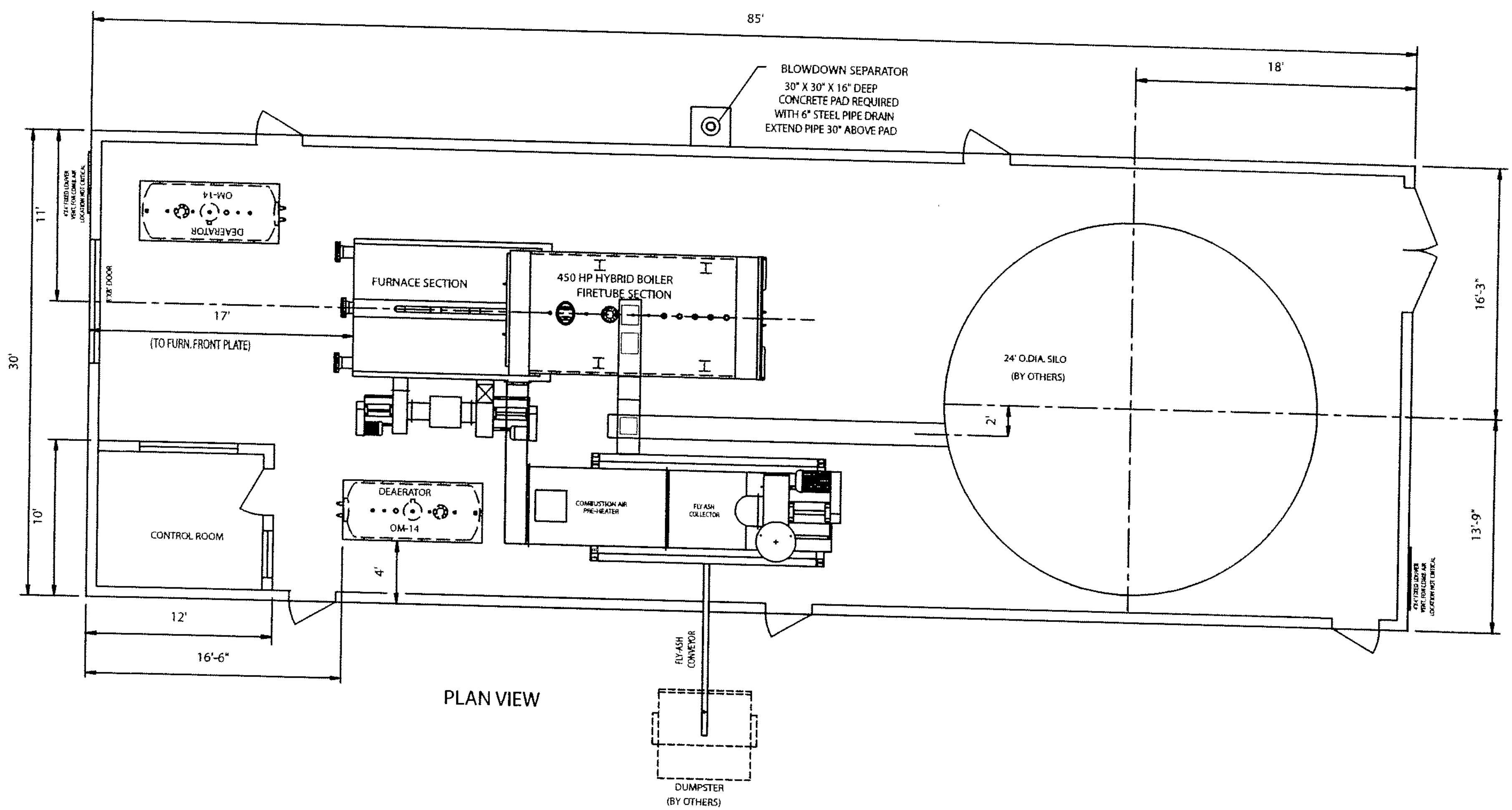


SFD# 150 HP
Hybrid w/ walking floor
fuel feed system.



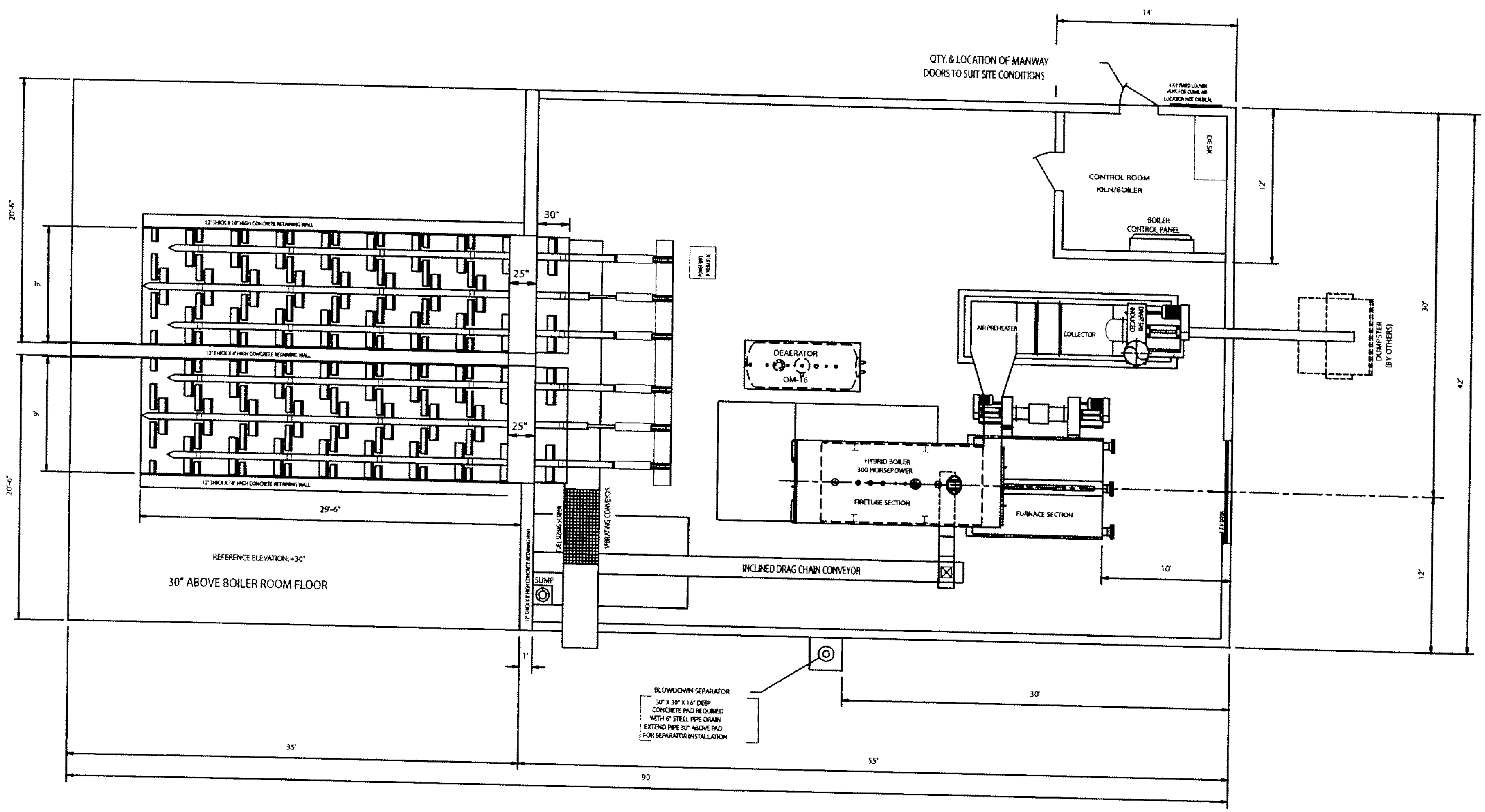
PLAN VIEW

SFD# 450 HP pg01
Hybrid w/ walking floor
fuel feed system.

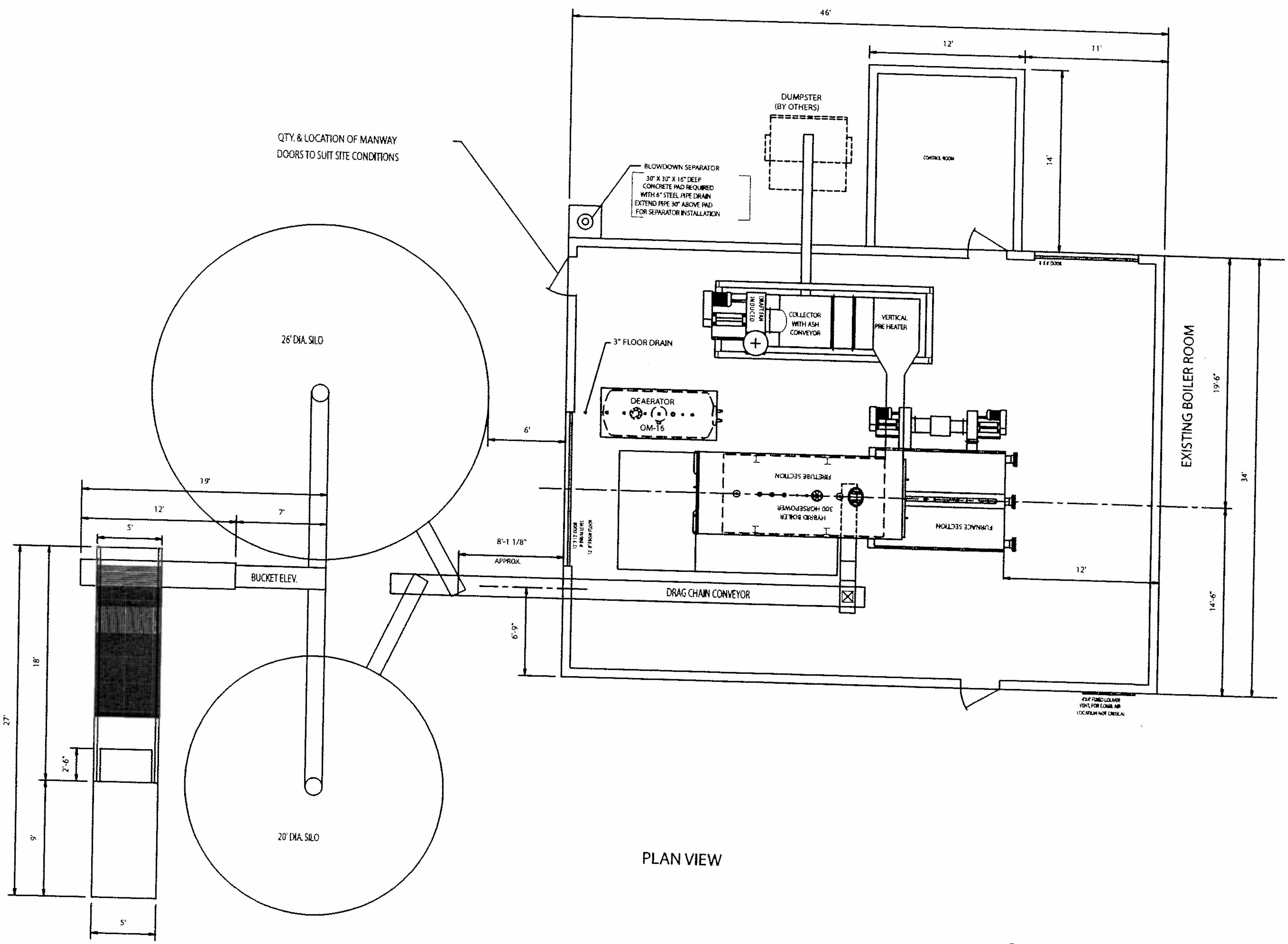


PLAN VIEW

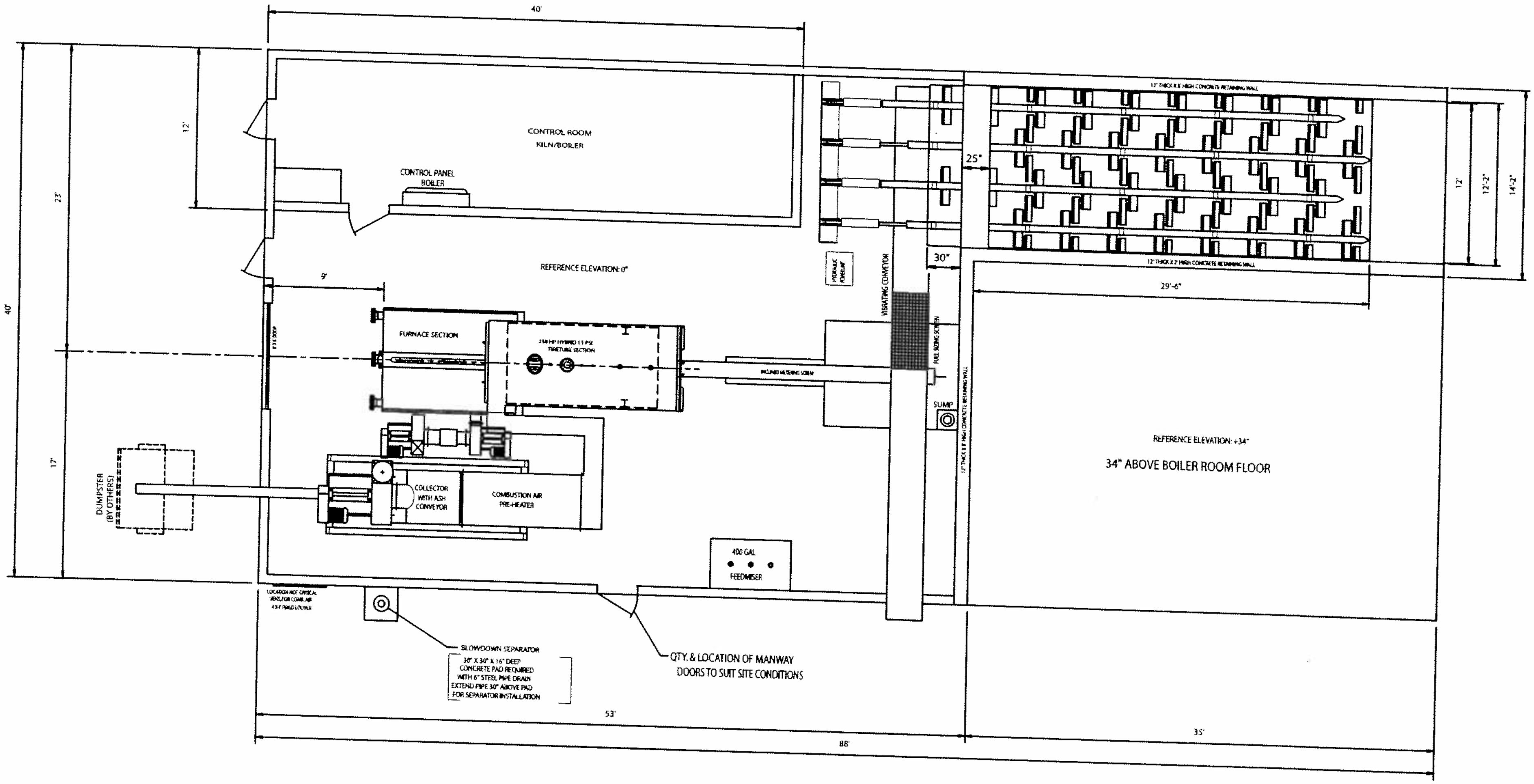
SFD# 450 HP pg02
Hybrid w/ silo
fuel feed system.



SFD# 300 HP
pg01
Hybrid w/ walking floor
fuel feed system.



SFD# 300 HP
pg02
Hybrid w/ silo
fuel feed system.



PLAN VIEW

SFD# 250 HP
Hybrid w/ walking floor
fuel feed system.

Tok Community Umbrella Corporation
Box 547
Tok, AK 99780-0547

March 6, 2008

Senator Albert Kookesh
State Capitol, Room 11
Juneau, AK 99801-1182

Representative Woodie Salmon
State Capitol, Room 114
Juneau, AK 99801-1182

Dear Senator Kookesh and Representative Salmon:

Enclosed are petition signatures in support of our Capital Improvement Project (CIP) request, sent to you earlier, for the Upper Tanana Valley Renewable Resources Initiative. This project, for a wood chipper, boilers, and wildfire remediation funds, will benefit all residents of the area, including the villages of Tanacross, Dot Lake, Mentasta, Tetlin, Northway and potentially even Chistochina. In addition to support from the residents of the Tok community, all of the Native villages in the region support this proposal and did a significant part of the work in putting the proposal together.

Please help all of the communities in this region by supporting our proposal. If you have any questions or need anything further, please feel free to give me a call or send me an email. I can be reached at home at 883-5320, at work at 883-4481, or by email to kmorgan@aptalaska.net.

I saw in your newsletter that you helped to defeat the Ketchikan borough annexation.

ENCLOSURES

Sincerely,

Kathy I. Morgan

Kathy I. Morgan, President

LETER TO THE EDITOR OF MUKLUK NEWS
WRITTEN BY DON MARSHALL SR

Fire means Heat--Heat means energy

Tok, the sinew of Alaska. Why?. Think about it. Our little community is about 350 miles from Anchorage, 200 miles from Fairbanks and many miles from anyplace else in Alaska. There are those who maintain the name Tok really means 'No Place". Regardless all supplies, food, fuel, building materials, clothing, & tourists, in short anything that comes into Alaska by road *must* come through our little community. Tok is equivalent of the Apian Way of Ancient Rome, the Silk Road of the Orient, the Burma Road of China even the Chunnel between France and England.

All this means if any of the roads in or out of Tok are cut off, the entire State of Alaska will be sorely affected.

Everything points to a very dry and hot summer just a few months away the threat of FIRE is real and Tok is surrounded by almost *nine million acres* of highly volatile material in the form of dead or dying foliage. Homes are in danger to say nothing of lives, falling trees will cut power lines, dense smoke will hamper Medivac planes in addition to blinding planes carrying fire retardents. Traffic in all directions will be disrupted

Ambulances and Fire Equipment will hampered by blocked roads. Troopers will be sorely pressed in maintaining order.

Thirty nine thousand of those tinder dry acres are in the immediate Tok area, most of these acres are accessible only by narrow one way lanes or driveways including those leading not only to our homes but to our all important source of water, the Tok and Tanana rivers .

All these blocked areas must be cleared and cleared soon. Fire lanes must be established by our hard working but understaffed and under equipped Depts of Forestry and our local volunteer Fire Department.

O.K. the obvious question is suppose we get all those driveways, back roads and fire lanes open. Problem solved? No! What to do with all the material that formerly went to the burning pit on Tok cutoff. What a terrible waste of energy. The BTUs (British Thermal Units) being so unproductive is nothing short of criminal.

There is now in the works the Upper Tanana

Valley Renewable Resources Initiative proposal burn that slash wood, those Formerly wasted BTUs, in steam boilers to augment the present oil fired units. Remember now, these BTUs are free! As opposed to, at this writing, the cost of oil for fuel to our school is $3.49 a gallon!

Slash wood is Free!! With steam boilers installed in the school and other government buildings will cut present expenditures (the Tok school alone spends $168,000 per year on heating oil). Remember now, when that oil is gone it's *gone*. The only thing remaining is the pollutants that oil, coal too, spreads in the air. Wood burning emits only carbon which as any high school chemistry student can tell you is what trees and other flora thrive on. In other words, burning free slash can cut fuel bills by 80% and *free slash is a renewable resource* Canada has already beaten us to the punch with half a dozen provinces supplying the heat in their public schools and buildings.

What's more is a little school down in Darby Montana is already using this very plan and it works great. The Darby school is the same size at Tok school and they have only 50 acres to obtain their fuel slash. We have 9 *million* acres, enough for Tetlin, Northway, Dot Lake, Tok and any other school you can think of plus number of government buildings that would be possible to heat.

At 80 % savings the initial cost would be covered in 3-4 years with no cost to us plus the advantage of lower fires insurance and saving our homes and town from turning to cinders.

Oh oh, just thought of something else. Cleaning the forest as I have described would give us advantage over the pesky Spruce beetle that is now moving this way plus cleaner more beautiful, healthier trees along with other foliage. Cleaner water, more ducks. Moose, and other animals would also be a bonus.

Get behind the Upper Tanana Valley Renewable Resource Initiative with a call to our Reps and maybe even a letter to Gov. Palin.

For more complete info on this measure contact Kathy Morgan (Tok Community Umbrella Corporation or Tok Division of Forestry).

Thank You

Don & Johnny

Upper Tanana Valley Wood Chipper & Boilers

The Tok Community Umbrella Corporation proposes to ask the Alaska Legislature for a grant to purchase a large whole-tree wood chipper, which can chop entire trees, including branches, into chips. The chipper could convert dangerous wildfire fuel into chips that could be used in efficient wood chip boilers to heat the Tok school and other public buildings at a much lower cost than currently paid for fuel oil, getting rid of a fire danger and saving heating costs at the same time. Tok sits in the middle of 38,000 acres of spindly old growth spruce forest which constitutes an extreme wildfire hazard which could destroy the entire community. Other communities in the Upper Tanana Valley are similarly threatened. We, the undersigned residents of the Upper Tanana Valley, support this proposal.

Signature	Physical Address	Mailing Address
[illegible] Hart	[illegible]	PO Box 172 Tok
[illegible]	Moose Nugget Rd	PO Box 531 Tok
[illegible]		[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible] Tok 99780
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	
Charity Walker	Midnight Sun	PO Box 1021
Amos W. David	Moose horn Rd	
[illegible]	Tetlin Village	Box 423 Tok

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Signature	Physical Address	Mailing Address
[illegible]		Box 871 Tok AK 99780
CHRIS YORK		PO Box 574 TOK AK 99780
William [illegible]		P.O. Box 712 Tok AK 99780
Donald Abie	Tetlin	Tetlin AK 99779
Danny Abe	Tetlin	Tetlin AK
Daniel [illegible]	TOK	344 Tok AK 99780
[illegible]	TOK	PO BOX 222 TOK AK 99780
J. Scott [illegible]	Tanacross	PO BOX 76067 Tanacross AK 99787
[illegible] L. Williams	TOK	Box 1018 TOK AK 99780
Norma M Wilkinson	TOK	Bo 1018 TOK AK 99780
[illegible]	Tok	Box 802 Tok AK 99780
[illegible]	TOK AK	HC63 Box 1221 Tok AK
Nancy Paul	Tanacross AK	P Box 76073 Tanacross 99776
Larry [illegible]	TOK	PO Box 425, Tok
[illegible]	Tok	PO Box 151 Tok AK 99780
[illegible]	TOK	Box 871 Tok AK 99780
[illegible] Tok	Tok	Box 742 Tok AK 99780

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Signature	Physical Address	Mailing Address
Margaret [illegible] Kozlowski	Sundog Road	PO B 302 Tok AK 99780
[illegible]	[illegible]	[illegible]
Butch Culman	Sundog Trail	P.O. Box 32 Tok
[illegible]	[illegible]	[illegible]
[illegible]	Borealis	P.O. Box 367 Tok AK 99780
David Young	Schiavulli Drive	PO Box 351 Tok Ak.
[illegible] Eagle	[illegible] St	PO Box 457 Tok
Rose [illegible]	[illegible] Box 541	Northway AK
[illegible]	[illegible]	[illegible] Tok
[illegible]	[illegible]	PO Box 143 Tok
[illegible]	436 [illegible] 99775	PO Box 7502[illegible] 99775
[illegible]	[illegible] St	PO Box 451 Tok AK 99780
[illegible]	[illegible] Lane	PO Box [illegible] Tok AK 99780
Ted [illegible]	Ted Morris	Po Box 654 Tok Ak 99780
Ted [illegible]	1320 AK Hiway Ted [illegible]	PO Box 703 Tok AK 99780
[illegible]	[illegible] PO 655 Tok Ak	P.O.B. 55 Tok AK 99780
[illegible]	[illegible]	PO Box [illegible] Tok AK 99780

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Signature	Physical Address	Mailing Address
Janet [illegible]	Riverside	PO Box 306 Tok AK 99780
[illegible] Young	West Willow Way	PO Box 78 Tok, AK 99780
Kristie Young	West Willow Way	PO Box 813 Tok AK 99780
[illegible]	1316.2 AK Hwy	PO Box 934 Tok, AK 99780
[illegible]	1312.5 AK Hwy	PO Box 357 Tok AK 99780
Dan Lee	1317.5 AK Hwy	Box 661 TOK AK 99780
Travis Kaus	1313 AK Hwy	Box 107 TOK AK 99780
[illegible]	Love Ln & Willow	Box 558 Tok 99780
[illegible]	1308 AK Hwy	PO Box 42 Tok 99780
[illegible] Wilkinson	671 Borealis	PO Box 671 Tok 99780
[illegible]	2nd Spruce	PO Box 752
[illegible]	Mile 1314 AK Hwy	Box 511
[illegible]	Mile 1319.3 AK Hwy	Box 462
[illegible]	3 Willow	PO Box CZN Tok 99780
[illegible]	D St.	374 TOK
[illegible]	D ST.	374. TOK
[illegible]	milepost 1318	Tok

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Signature	Physical Address	Mailing Address
Mary Saunders	Borealis Ave	POB 592 Tok
Jerry Isaac	P.O. Box 76007	TANACROSS, AK. 99776
[illegible]	PO Box 6004	Mentasta AK 99780
[illegible]	Box 6004	Mentasta 99780
[illegible]	Box 286	Tok 99780
Floyd D. Seigler	Box 891	TOK 99780.
[illegible]	Box 891	Tok 99780
[illegible]	Box 491	Tok
Vanessa [illegible] Thompson	Box 75	Tok AK
Sharon [illegible]	367 Borealis Ave Box 367	Tok, AK 99780
[illegible]	PO Box 76054 House # 10	TANACROSS, AK
Cheryl Hosker	PO Box 513 Mile .75 West Willow	Box 513 Tok Ak 99780
[illegible]	PO Box 854 #213 Spruce St	Tok, AK 99780
[illegible]	[illegible]	[illegible]

Upper Tanana Valley Wood Chipper & Boilers

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Signature	Physical Address	Mailing Address
[illegible]	1318.5 AK Hwy	[illegible] Box 399
[illegible]	1318.5 AK Hwy	P.O. Box 42 - Tok
[illegible]	[illegible] St.	P.O. Box 72 Tok
[illegible]	Midnight Sun / Sanford	P.O. BOX 293
[illegible]	Greatland [illegible]	P.O. Box 123 Tok, AK
Betty T. Denny	Tanacross	P.O. BOX 284 Tok
[illegible]	[illegible]	P.O. BOX 402 - Northway AK
[illegible]	Greatland Dr Tok	Box 123 Tok AK 99780
Harry Frank	Northway	Northway
[illegible] Helmer	Tok / Sun Dog	Box 841 TOK AK
[illegible]	3 A Tcos Johnny Rd	Box 561, TOK
Susan Helmer	Tok Sundog tr	Bx 841, tok
[illegible]	E. First St TOK. AK	PO BOX 164
[illegible]	TOK. AK	PO Box 293 TOK
Brooke R Baker	Tok, AK	PO Box 888 Tok
JoAnn Lohnes	Tok AK	Box 411 Tok
[illegible]	tok ak	Box 172 tok

Upper Tanana Valley Wood Chipper & Boilers

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Signature	Physical Address	Mailing Address
[illegible]	82 EAST 2nd ST. TOK	P.O. BOX 427 TOK 99780
[illegible]	1318 1/2 AK Hwy	P.O. Box 661 TOK AK 99780
[illegible]	[illegible]	P.O. Box 574 TOK AK 99780
[illegible]	P.O. Box 1024 Tok	Sun Dog Dr. 99780
[illegible]	P.O. Box 962 Tok	~~1321~~ MP 1321 Alhwy
[illegible]	1322.5 AK Hwy Box 605 TOK	Box 605 TOK, AK 99780
[illegible]	MP 1321 AK Hwy	P.O. Box 962 TOK, AK 99780
[illegible]	Box 54 (Mile 1309)	P.O. Box 54 TOK, AK 99780
[illegible]	Mile 123 Tok Cutoff	P.O. Box 705 Tok, AK ~~99780~~
[illegible]	1313 AK Hwy	Box 41 Tok AK 99780

Upper Tanana Valley Wood Chipper & Boilers

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Signature	Physical Address	Mailing Address
Kathy J. Morgan	5th Ave, Tok	Box 342, Tok
Tim West	1315.8 AK HWY	PO BOX 781, TOK
Robert Paul Sr	Tanacross, AK	
James Withke	1 Discovery Ln.	P.O. Box 228 - Tok AK 99780
[illegible]	Airport wy	PO Box 1013
[illegible]	[illegible] Creek	PBX 654

Upper Tanana Valley Wood Chipper & Boilers

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Signature	Physical Address	Mailing Address
Dennis Brinkman	[illegible]	Box 342 Tok Alaska
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
Judy [illegible]	1318.5 AK Hwy Tok	PO Box 58 Tok AK 99780
Linda Maynard	1322.5 AK Hwy Tok	P.O. Box 923 99780
Terry Brigner	1/4 Mi. Butch Kuth Ave	Box. 474 Tok 99780
Grace Brigner	1/4 Mi. Butch Kuth Ave	Box 474, Tok 99780
[illegible]	[illegible]	Box 713 Tok Ak 99780
[illegible]	1316 Mi [illegible]	Box 312 Tok AK 99780
[illegible]	W 'C' St. Ext Tok AK	PO Box 756 Tok 9978[illegible]
[illegible]	West C St. Ext Tok AK	POB 756 Tok AK 99780
[illegible]	[illegible]	[illegible]
[illegible]	1314.3 Alaska Hwy	POB 111 Tok
[illegible]	[illegible]	[illegible]
[illegible]	501 Borealis Ave	PO Box 501, Tok
[illegible]	Mi 1.57 Tok Cut-off	HC 72 Box 840 Tok
[illegible]	Vickie St Tok, AK	P.O. Box 833 Tok

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Signature	Physical Address	Mailing Address
[illegible] Tim Skeeke	Willow St.	P.O Box 673 Tok. AK.
[illegible]	Willow St	P.O. Box 673 Tok. AK
Fred Boden	Spruce Ct.	Box 214 Anchor Pt.
Edward Hoog	W Willow	Box 991 Tok, AK
Andrea Sutton	Red Fox Rd.	Box 751 Tok, AK
[illegible]	1315 AK Hwy	Box 704 Tok
[illegible]	[illegible]	[illegible] 175 Tok
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	PO Box 954, Tok
[illegible]	Summer street	PO Box 722 Tok
[illegible]	Mile 1315.5 AK Hwy	PO Box 646 Tok

[illegible]

Upper Tanana Valley Wood Chipper & Boilers

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Signature	Physical Address	Mailing Address
[illegible]	161 [illegible] Lane	Box 386 Tok